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ERRATA

VOLUME XXII

page 463 lines 24 and 27 for 'leek' read 'onion'

531 delete *Citrivir psorosis* var. *concavum*, Citrus blind pocket psorosis, and Citrus concave gum psorosis entries

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12 line 8 for '*secalina*' read '*dispersa*'

119 25 for '*Trichoconas*' read '*Trichoconis*'

136 10 for '*mali*' read '*rubi*'

266 5 for 'ROLLENBACHER' read 'BOLLENBACHER'

293 2 for 'xxiii' read 'xxii'

302 23 for 'skin' read 'shin'

307 6 for 'Hildebrand (E. N.)' read 'Hildebrand (E. M.)'

307 11 insert 'and' after 'blackberry'

316 10 for '*A. zeae*, while *P.* [*A.*]' read '*zeae*, while *P.* (*A.*)'

374 32 for '*oxysporum*' read '*bulbigenum*'

382 48 for '*Chrosopogon*' read '*Chrysopogon*'

438 45 for '*Atropha*' read '*Atropa*'

512 34 for '*canadensis*' read '*canadense*'

IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW
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VIRGIN (W. J.). **An unusual Bean disease.**—*Phytopathology*, xxxiii, 8, pp. 743–745, 1 fig., 1943.

Field and garden beans, especially of the Bountiful variety, grown for seed in southern Idaho, have been observed to suffer from an apparently new disease, characterized by a marked reddish discoloration of the nodes, later extending to the veins and sometimes to the pods. The leaves are misshapen and the plants stunted, few pods are formed, and ripening is premature. The seeds are usually small, often shrivelled, and the coats deeply marked with target-like spots or concentric lines. The disease, which is most prevalent along the edges of bean fields, is believed from the evidence available to date to be caused by a virus closely allied to bean virus 2 (yellow mosaic) [*R.A.M.*, xvii, p. 90]. The plants developing from 48 seeds from affected plants grew to maturity without showing any symptoms of the virus, which is thus apparently not transmissible by way of the seed.

JENKINS (ANNA E.) & VIÉGAS (A. P.). **Stem and foliage scab of Sweet Potato (Ipomoea batatas).**—*J. Wash. Acad. Sci.*, xxxiii, 8, pp. 244–249, 2 figs., 1943.

In connexion with the recent detection of stem and foliar scab of sweet potato, due to *Sphaceloma batatas* Sawada (Descriptive catalog of Formosan fungi, Part 5, p. 105, 1931), on the island of Guam and in different parts of Brazil (in Alagoinhas by Fawcett and Bitancourt in 1937 and in Campinas by Costa in 1939), the writers summarize the available information on the disease, including that contained in the Japanese papers by Sawada and Goto (*Ann. phytopath. Soc. Japan*, vii, pp. 143–145, 1937), and reproduce the original diagnosis of the pathogen. On stem cankers from Campinas a species of *Elsinoe* was found which is suspected of being the ascigerous stage of *S. batatas* and is named *E. batatas* n.sp.

Under the conditions prevailing in São Paulo and Bahia, Brazil, the spots produced by *E. batatas* on the interveinal areas, veins, and petioles are usually circular, small, and mikado-brown on the dried specimen, those on the stems being circular, elliptical, or elongated, Hay's brown, often with a wood-brown centre; the mycelium is at first intraepidermal and then passes to the subepidermal tissue, causing hypertrophy of the cortical parenchyma and collenchyma, followed by collapse and necrosis of the affected regions; during this process the dark grey hyphae develop into an external stroma, 20 to 60 by 16 to 20 μ, with a single row of globose asci, 15 to 16 by 10 to 12 μ, containing 4 to (?) 6 hyaline, septate curved spores, 7 to 8 by 3 to 4 μ.

The specimens submitted by R. G. Oakley from Guam in 1937 were examined by the senior writer and Sawada and found to agree with the original description of the disease and its agent. A conspicuous feature of the disease in the field was the high, erect growth of the shoots. In 1938 the incidence of infection declined, and in 1939 diseased plants were scarcely to be found.

General review of research work.—*Rep. E. Malling Res. Sta., 1942*, pp. 22–30, 1943.

R. V. Harris (pp. 22–24) states that when plum bark extracts were tested against *Pseudomonas mors-prunorum* [*R.A.M.*, xxii, p. 100] in culture, no differential effect correlated with origin from resistant or susceptible varieties was observed. The organism utilized a wide range of food materials and resistance did not appear to be due to their shortage. Bark tissue was invaded intercellularly, cells being entered only after collapse.

H. B. S. Montgomery, M. H. Moore, H. Shaw, and W. Steer (pp. 25–27) state that in further spraying tests against apple scab [*Venturia inaequalis*] phenyl mercury chloride proved highly fungicidal, though not entirely safe. Of the inorganic sulphur sprays (tested at equivalent sulphur based on 1 per cent. lime-sulphur), colloidal sulphur alone, and lime-sulphur alone or as mixtures with commercial elementary sulphur preparations proved to be the most effective against scab. Tetramethylthiuram disulphide was unsatisfactory. Spray treatment of Allington Pippin and Worcester Pearmain apple trees in full bloom with 1 per cent. lime-sulphur or 0·5 per cent. colloidal sulphur reduced scab and did not decrease the crop. Infection by *V. inaequalis* was light in 1942, in contrast to 1941, but moderate annual dressings of sulphate of ammonia applied over a period of years to well-grown Cox's Orange Pippin and Allington Pippin trees had a cumulative effect in increasing susceptibility to scab. This, however, did not apply to sickly trees of the same varieties. Grassing down Cox's Orange Pippin trees appeared to reduce canker [*Nectria galligena*].

W. G. Keyworth (pp. 28–29) states that increased publicity was afforded to the need for the prompt notification of outbreaks of *Verticillium* wilt [*V. albo-atrum* and *V. dahliae*: ibid., xxii, p. 175] of hops and the application of control measures. Twenty-two new outbreaks were reported. Evidence was obtained that the blowing-about of infected plant debris is probably partly responsible for spread. Two new outbreaks of *Armillaria mellea* [ibid., xxii, p. 39] were found. Fuggle cuttings from 33 farms in the Kentish Weald and 16 in Worcestershire were inarched to mosaic-susceptible Golding hops. The grafts showed that 78 of the 95 Weald Fuggles (from 32 of the 33 farms) and 52 of the 74 Worcester Fuggles (from 14 of the 16 farms) were infected with mosaic. This shows how undesirable it is that Fuggles and Golding hops should be planted in close proximity, a view confirmed by field surveys.

Conners (I. L.) & Savile (D. B. O.). **Twenty-second Annual Report of the Canadian Plant Disease Survey, 1942.**—xix+110 pp., 1943. [Mimeographed.]

In this report [cf. *R.A.M.*, xxii, p. 9], it is stated that stem rust (*Puccinia graminis*) caused almost no damage to wheat in Canada in 1942. Leaf rust (*P. triticina*) was fairly prevalent on the stem rust-resistant varieties Thatcher and Apex, but only slight on Regent and Renown, which are resistant to both rusts. Additional evidence was obtained in New Brunswick that local epidemics of crown rust (*P. coronata*) and stem rust (*P. graminis*) on oats are due to plantings of the alternate hosts.

Browning root rot (*Pythium* spp.) [ibid., xxii, p. 26] caused very severe lesions of the roots of cereals, but growing conditions being favourable, recovery was general and yields moderate, although the damage delayed ripening and increased susceptibility to frost injury. Isolations from field material indicated that foxtail millet (*Setaria italica*) and broomcorn millet (*Panicum miliaceum*) may sustain considerable damage from browning root rot.

The possibility of leaf blotch of oats (*Helminthosporium avenae*) being at times an important seedling blight in Canada is indicated by its high incidence in the

seed, the relatively severe leaf infections in the field following sowing of heavily infected seed, and by its presence under cool greenhouse conditions. Primary infection of barley in net blotch (*H. teres*) and spot blotch (*H. sativum*) of barley may also be largely due to infected seed.

Covered smut (*Ustilago hordei*) and black (loose) smut (*U. medians* or *U. nigra*) of barley were prevalent in Plush barley in Manitoba, destroying 40 to 50 per cent. of the heads in some fields.

Crown rot of lucerne, due to a low-temperature Basidiomycete [ibid., xxii, p. 27], was very destructive in the early spring in Alberta, and did considerable damage in north-eastern Saskatchewan. Witches' broom of lucerne [ibid., xxii, p. 240], due to a virus, is reported from British Columbia, this being the first definite indication of its economic importance in Canada.

Flax rust (*Melampsora lini*) was general and reached epidemic proportions in some fields in the Prairies. It was most severe on the Bison variety; Redwing was fairly susceptible, while Royal appeared to be quite resistant. Observations indicated that rust was worse in fields near those carrying flax the previous year or where bits of rusted straw were present in the seed.

Pod and stem blight (*Diaporthe phaseolorum* var. *sojae*) was the most important disease of soy-beans in Ontario. Both blight and anthracnose (*Colletotrichum glycines*) are stated to be new to Canada.

Bacterial blight (*Xanthomonas phaseoli*) and especially halo blight (*Pseudomonas medicaginis* var. *phaseolicola*) were generally prevalent on beans and particularly destructive in southern Alberta. Aster yellows continues to be destructive in carrots in the Maritime Provinces. A yellows, believed to be due to the beet curly-top virus, is reported on carrots in the Okanagan Valley, British Columbia, where two new diseases were also observed, namely, downy mildew (*Peronospora schleideniana* [*P. destructor*]), which destroyed about half the onion crop, and anthracnose (*Marssonina panattoniana*) on lettuce. *Phoma betae* and *Ramularia betae* were found for the first time causing leaf spots of swiss chard [*Beta vulgaris* var. *cicla*] in Canada. Potato virus X, one of the components causing streak in tomatoes in mixed-virus infections, was found alone for the first time in Ontario in tomatoes in which it caused an indistinct vein-banding.

Bacterial ring rot (*Corynebacterium sepedonicum*) of potato affected approximately half the commercial acreage in southern Alberta, and has spread to the Eastern Irrigation District. It was observed for the first time in British Columbia and was also present, though in negligible amounts, in certified stock in the other Provinces, except Nova Scotia. For the second year only a single case was found in Prince Edward Island; in New Brunswick it has apparently been controlled in certified seed, but in Quebec it continues to be prevalent, due to disregard of sanitary measures. To prevent still further the possible contamination of healthy stocks of certified seed, the table stock of each grower is inspected and if ring rot is found in any field on his farm no seed stocks are certified from that farm.

A careful survey of plantings of 'English' potatoes revealed no additional cases of wart (*Synchytrium endobioticum*) in Nova Scotia.

Purple top of potatoes, possibly caused by the aster yellows virus [ibid., xxii, p. 493], was unusually prevalent in the Maritime Provinces, where it has been observed more or less frequently since 1939, more and more plants becoming affected as the season advances. The disease was most common in Katahdin, attacking only a few plants of Green Mountain.

The Wisconsin leaf spot of tobacco (*Pseudomonas mellea*) occurred in epidemic form in Quebec, this being the first record in Canada. Tobacco mosaic in Ontario and Quebec is apparently due partly to the virus of tobacco mosaic and partly to that of cucumber mosaic, the latter virus being more prevalent than the former in Quebec, where pipe and cigar-leaf tobacco is grown in comparatively small plots.

Fireblight (*Erwinia amylovora*) of apple, first reported from Alberta in 1941, is quickly becoming established there. Perennial canker (*Neofabraea perennans*) was prevalent in the Okanagan Valley, British Columbia, but losses have been greatly reduced since the introduction of the woolly aphid parasite, *Aphelinus mali.*

Isolations indicated that most of the blossom and twig blight in cherry and plum in the coastal region of British Columbia is due to *Sclerotinia laxa*, although *S. fructicola* also occurs. Bacterial blight (*X. pruni*) was of considerable importance on peaches in Lincoln County, Ontario, particularly in orchards on Lake Ontario. Western X disease of peach has increased in the southern Okanagan Valley, British Columbia, since the first survey in 1940. Trees affected by this virus are often difficult to detect. Although X disease was found in the Niagara Peninsula, Ontario, only in 1941, it is believed to have been present there several years earlier. Evidence has been collected that the chokecherry [*Prunus virginiana*] is not essential for the spread of this disease, but that it may spread directly from peach to peach over considerable distances. X disease was also found severely attacking chokecherries near Brighton and Port Hope, to the east of Toronto.

Shot hole (*Cercospora circumcissa*) severely affected plums and Sioux sandcherry [*Prunus besseyi*] in Manitoba. This is the first report of the fungus in the Survey, but it is represented in the Herbarium by specimens on *P. virginiana* from Quebec and on this host and on *P. serotina* from Ontario.

Further mentioned are leaf spot (*Labrella coryli*) on *Corylus rostrata* in British Columbia; brown mould (*Gonatorrhodiella highlei*) associated with *Nectria* canker on beech in New Brunswick and Nova Scotia; canker and die-back (*Fusarium lateritium* var. *mori*) on mulberry, and leaf blight (*Rhabdogloeum pseudotsugae*) associated with *Rhabdocline* on Douglas fir in British Columbia.

New records of diseases of ornamentals are bacterial blight (*X. incanae*) on greenhouse stocks in Ontario; anthracnose (*Sphaceloma rosarum*) on rose in British Columbia and Manitoba; stem rot (*Sclerotinia sclerotiorum*) on tulip in British Columbia; and rust (*Endophyllum sempervivi*) on *Sempervivum* spp., new to Ontario, but previously reported from British Columbia.

Seventeenth Annual Report of the Department of Scientific and Industrial Research, New Zealand, 1941–1942.—44 pp., 1943.

In this report [cf. *R.A.M.*, xxii, p. 125] it is stated that experimental evidence in New Zealand indicated that the period of maximum susceptibility of Granny Smith apples to superficial scald was between the ninth and the twelfth weeks of cold storage. When fruits of two pickings were stored in plain and oiled wraps, the latter delayed the appearance of scald by eight and eleven weeks in the first and second pickings, respectively. The evidence indicated that whatever the date of picking or the kind of wrapper used, scald is reduced to a minimum if the fruit is stored immediately or if storage is delayed for not less than four weeks. Long-delayed storage, however, produces undesirable effects on maturity and favours attack by fungi. The most successful results in the cold storage of Granny Smith apples appear to be given by using oiled wraps, storing immediately, and avoiding early picking.

In further studies on the effects of manurial treatments on the storage quality of apples [ibid., xxi, p. 3], nitrogen again greatly increased susceptibility to breakdown and fungal attack in Cox's Orange Pippin, though it reduced wilt. Phosphorus and potassium without nitrogen gave less breakdown and fungal infection, but more wilt, than the untreated control. With Dunn's Favourite, a heavy application of 4 lb. [? per tree] ammonium sulphate in addition to the normal dressings of phosphorus and potassium increased both breakdown and fungal infection. With Jonathan, applications of 2 and 4 lb. ammonium sulphate caused progressive increases in the incidence of breakdown, but only the heavier applica-

tion increased fungal attack. Potash again reduced the incidence of breakdown and fungal infection, particularly in late pickings, and only slightly increased Jonathan spot. The storage quality of Delicious apples continued to be unaffected by manurial treatments. In the case of the Sturmer variety, nitrogen, unbalanced by phosphorus and potassium, greatly increased breakdown and infection, but reduced wilt.

Tests on the effects of various sprays and other factors on the incidence of ripe spot of apples (*Neofabraea malicorticis*) [ibid., xxii, p. 126] suggested that fruit maturity and storage conditions are the main factors influencing the development of this disease. Unsprayed control fruit developed considerable ripe spot in cold storage, but this was reduced by 57 and nearly 95 per cent., respectively, where lime-sulphur had been applied as a summer spray and late summer applications of Bordeaux mixture had been used.

Bacterium [*Xanthomonas*] *pruni* [loc. cit.] is widespread throughout New Zealand on plum, and spray experiments for its control are in progress.

Onion downy mildew [*Peronospora destructor*] was largely controlled by Bordeaux sprays with various spreaders and wetting agents, with the result that increased yields were obtained. Pre-emergence damping-off of peas, which induces severe mortality and loss of vigour in early-sown plants under conditions of high soil moisture, was controlled by copper oxide and copper carbonate dusts, the former being slightly the more effective. Bean wilt [? *Pseudomonas medicaginis* var. *phaseolicola*: ibid., xix, p. 644] is becoming a serious problem. The only practicable method of control is to plant resistant varieties. Of 41 commercial varieties tested in three localities, only two were found to be immune, though several others were resistant enough to suffer only negligible loss. These are being propagated in order to build up stocks of seed.

The commercial production of high-alkaloid ergot [*Claviceps purpurea*] on rye [ibid., xxi, p. 453] appears to offer small prospects of success in New Zealand.

During the past three seasons, the amount of mosaic on typical blocks of tobacco at the Tobacco Research Station [ibid., xxii, p. 126] has been reduced from over 40 to under 5 per cent. initial infection. This result has been due mainly to the removal of sources of infection and careful handling of the seedlings. The results obtained during the present season showed that the percentage of mosaic was higher among pricked-out than bed-sown plants. This difference was most apparent with the higher rates of manurial treatment in the seed-bed. With both kinds of plants, mosaic incidence increased when the manurial treatment of the seed-bed was increased but on the whole the increments were small. Doubling the rate of application of standard fertilizer in the field did not appreciably increase the percentage of initial mosaic. The continuous tobacco plot and the alternate oats–tobacco plots showed 2·3 and 1·8 per cent. mosaic, respectively. Incorporation of tobacco trash in the seedling-bed soil increased mosaic in the seedlings. Soil suspensions from a bed treated two months before with tobacco trash when inoculated into tobacco seedlings gave 50 per cent. infection. Milk spray (1 : 10 with water) gave some protection against mosaic in the seedling-beds.

[Waterston (J. M.).] **Plant pathology.**—*Rep. Dep. Agric. Bermuda, 1942*, pp. 8–9, 1943.

The spread of fungal and bacterial diseases was promoted by wet weather during the period under review [cf. *R.A.M.*, xxi, p. 321]. Cabbage and broccoli were attacked by *Xanthomonas campestris* and tomatoes by *X. vesicatoria*. The Sebago potato variety showed satisfactory resistance to blight (*Phytophthora infestans*) [ibid., xx, p. 31 *et passim*], the incidence of which was reduced by the use of spraying equipment provided by the Department of Agriculture. *Fusarium oxysporum* caused rotting of late-planted potatoes [ibid., xvi, p. 57], and the

completion of planting by 15th February is consequently recommended, so that digging may be carried out before the end of May. Bliss Triumph potatoes raised from Nebraska seed suffered heavy damage from scab (*Actinomyces scabies*), which was much less severe on those of Nova Scotian origin, even when both lots were grown in the same field. Stigmatomycosis (*Nematospora coryli*) was prevalent on string beans and Lima beans [*Phaseolus lunatus*], following infestation by the insect *Nezara viridula* in August. Fig plants imported from California were infected by a hitherto unobserved disease assumed to be mosaic (*Ficus* virus 1) [see below, p. 33]. *Phytomonas* [*X.*] *juglandis* attacked Placentia English walnut, while the adjacent Eureka variety remained healthy; these trees were also of Californian origin. The following fungi were found for the first time on diseased Bermuda cedar [*Juniperus bermudiana*]: *Pestalotia conigena*, *P. micheneri*, and *Stigmatea juniperi*; *Pithya cupressi* was isolated from cedar foliage, and year-old seedlings were killed by *Gymnosporangium bermudianum*.

A number of new records were added to the mycoflora of the Islands, on which the writer is engaged in collaboration with F. J. Seaver [ibid., xxii, p. 153].

WATERS (H. B.). **Report on the Department of Agriculture, Gold Coast, for the year 1942–43.**—8 pp., 1943.

Swollen shoot continued to attack cacao trees in the main area of infection from Koforidua to Suhum during the period covered by the report [cf. *R.A.M.*, xxii, pp. 13, 423], while outbreaks were also located in Akim (where they form a chain along the western side of the Atewa range as far south as the previously detected focus at Kobriso) and south-west of Kwahu. From October, 1942, spraying was omitted from the control programme, thereby expediting the treatment of over 200 outbreaks involving upwards of 89,000 trees. At the road barriers against the transference of planting materials several lots of pods and seedlings were seized. Swollen shoot appears from careful observations to spread relatively slowly, and it is hoped to organize an intensive survey of the whole cacao belt to determine the areas in which the industry could be protected by effective treatment. Some promise of varietal resistance to swollen shoot was obtained in tests at Tafo, and further work along these lines, comprising a wider range of West Indian types, has been planned.

Xanthosoma violaceum has proved highly, and two other introduced varieties fairly, resistant to coco-yam root rot [ibid., xix, p. 581], against which the 'roguing and replanting' treatment was once more successful. The virus theory of the origin of the disease is supported, but not established, by pot experiments.

Botany.—*Rep. Ga Exp. Sta., 1942–43*, pp. 40–48, 2 figs., [1943].

This report [cf. *R.A.M.*, xxii, p. 126] contains, *inter alia*, the following items of phytopathological interest. Applications of Bordeaux mixture to Muscadine [*Vitis rotundifolia*] grape vines for the control of black leaf spot due to a species of *Guignardia* [loc. cit.] induced a deeper colour of the foliage but no significant increase of yield. The disease was very severe on the unsprayed vines many of which lost a large percentage of their leaves before September.

In trials for the control of groundnut leaf spot [*Cercospora arachidicola* and *C. personata*: ibid., xxi, p. 126], the increase in yield of Spanish groundnuts given by sulphur dusting was 143·6 lb. per acre, as against an average increase of 329 lb. per acre for the previous five years. Copper-sulphur (10–90) dust in 10 tests gave an average increase of 218·6 lb. per acre. On the North Carolina Runner variety, two tests with three applications of sulphur dust gave an average increase of 219 lb. per acre, and two tests with four applications one of 381 lb. per acre. Two tests with Bordeaux spray indicated that such spraying is probably more effective than either of the dust treatments. Dusted groundnuts may safely be harvested 10 to 14 days after undusted.

The evidence so far obtained indicates that among the organisms attacking the roots and stems of snap beans [*Phaseolus vulgaris*] and largely responsible for the short bearing life of this host in Georgia, *Sclerotium rolfsii*, *Macrophomina phaseoli*, and *Rhizoctonia* [*Corticium*] *solani* are the most important. Attempts to control pea diseases caused by *Ascochyta pinodella*, *Mycosphaerella pinodes* [ibid., xxii, p. 290], and *Septoria pisi* by fertilizer treatments were unsuccessful, but the fact that infection was very severe on the fertilizer plots, where peas had been grown for seven consecutive years, and was virtually absent from fields in the vicinity where peas had been grown only once every three or four years emphasizes the need for rotation.

The watermelon S87, resistant to wilt [*Fusarium bulbigenum* var. *tracheiphilum*], was offered to farmers and seed-growers under the name Georgia Wilt Resistant. Strain X32 continued to show more resistance to both wilt and anthracnose [*Colletotrichum lagenarium*: ibid., xxi, p. 512] than other strains. Several promising selections of cantaloupe melons have been developed which are highly resistant both to downy and powdery mildew [*Pseudoperonospora cubensis* and *Erysiphe cichoracearum*], but further selection is, however, necessary to fix the type. The new Panamerica tomato variety, developed from a *Lycopersicum pimpinellifolium* ×Marglobe cross, appears to be more resistant to *Fusarium* wilt [*F. bulbigenum* var. *lycopersici*] than any other commercial variety ever tested at the Station.

Soil and plant investigations. Fruits and nuts, vegetable crops and diseases.—*Rep. Hawaii agric. Exp. Sta., 1941–42*, pp. 85–111, 6 figs., 1943.

In this report [cf. *R.A.M.*, xx, p. 350], it is stated that papaw anthracnose, caused by a species of *Colletotrichum* (probably *C. gloeosporioides*) [ibid., xxi, p. 149], appears in Hawaii on immature fruits only when they are treated with methyl bromide for the control of the Mediterranean fruit fly (*Ceratitis capitata*), or kept under anaerobic conditions for several days. Chloropicrin was very effective against damping-off of papaw [ibid., xxi, p. 150], caused by a species of *Rhizoctonia* and *Pythium aphanidermatum*. It did not, however, control subsequent infection. In a test in which this chemical was applied at the rate of 6 c.c. per cu. ft., the untreated control gave 71 per cent. total emergence, 0 per cent. post-emergence damping-off, and 71 per cent. final stand, the corresponding figures for *Rhizoctonia*-infected lots being 58, 53, and 5 per cent., for treated similar lots 80, 3 (insect larvae responsible), and 77 per cent., for *Pythium*-infected lots 51, 30, and 21 per cent., for treated similar lots 82, 0, and 82 per cent., and for treated infected lots reinfected with *Pythium* 9, 8, and 1 per cent.

Early in 1941, a third strain of bean rust (*Uromyces phaseoli typica*) [*U. appendiculatus*: ibid., xx, p. 556] appeared in Hawaii, to which four bean varieties which had been recommended as substitutes for the Lualualei variety proved to be susceptible. Other varieties, never before attacked, were highly susceptible or only slightly resistant.

During the period under review, 54 tomato varieties were tested for resistance to spotted wilt [ibid., xix, p. 482]. The selection BC–10 from the California Agricultural Experiment Station has so far remained immune in areas where susceptible varieties are severely affected. In 1941, the German Sugar variety (received from Honolulu) was ascertained to be highly resistant. Seeds of this variety were tested in a highly infected area at Kailua, Oahu, and its resistance was established.

Plant tumor bacteria.—*Science*, N.S., xcviii, 2537 (*Suppl.*), p. 10, 1943.

Further studies by P. R. White on the genesis of crown gall [*Bacterium tumefaciens*] in plants [*R.A.M.*, xxii, p. 241 and next abstract] have shown that the bacteria can be deprived of the tumour-producing capacity by culture on glycine-

containing media. The organisms thus treated can live in the host tissues, but excrescences do not develop unless the top of the plant is cut off and the tissues surrounding the point of inoculation treated with a hormone solution. Even then, however, bacteria isolated from the galls thus induced cannot form new tumours without the further aid of a growth-promoting substance. On the other hand, the introduction into healthy plants of germ-free tumours results in the development of large, malignant growths, indicating that the host cells have undergone in White's phrase a 'permanent and irreversible cancerization'.

To test the validity of the hypothesis that the bacteria themselves are not the agents of crown gall, but merely act as carriers of an infective virus, Madagascar periwinkle (*Vinca rosea*) plants were inoculated with *Bact. tumefaciens*. At 115° F. no symptoms developed, but at ordinary greenhouse temperature tumours were produced normally. In the meantime the bacteria had disappeared, having presumably first transmitted to the host tissues a tendency to pathological multiplication.

White (P. R.) & Braun (A. C.). **A cancerous neoplasm of plants produced by autonomous, bacteria-free crown-gall tissue.**—*Proc. Amer. phil. Soc.*, lxxxvi, 3, pp. 467–469, 1943.

Some further information is presented concerning the development in sunflowers of malignant secondary tumours after the elimination of the original pathogen, *Phytomonas* [*Bacterium*] *tumefaciens* [see preceding abstract]. Of 181 such excrescences, which arise near the vascular bundles at a distance of one or more internodes from the primary site of infection, tested during recent months, only seven (4 per cent.) yielded cultures of the crown-gall organism. Normal sunflower cells in tissue culture develop very slowly, increasing only about 250-fold in volume in a year in contrast to those from secondary crown-gall tumours, for which the corresponding figure exceeds 1,000,000,000,000-fold. The metastatic neoplasms are glistening white, except for occasional brown patches of necrotic cells, their surfaces being covered with innumerable white tubercles representing localized centres of more rapid growth. They are firm, friable, and contain scattered scalariform cells, which are not, however, organized into any coherent system. No bacteria were recovered from 600 such cultures subjected to careful bacteriological tests, while negative results were also given by serological experiments and others involving the use of a nutrient medium known to support the growth of *Bact. tumefaciens*. Moreover, on re-implantation into the host, living fragments of bacteria-free secondary tumour tissues rapidly induce the formation of typical crown galls. From about 600 such grafts made during the past year, 133 typical tumours have been obtained, ranging in size from minute nodules to a walnut. Successful grafts were made from tissue cultures derived from 11 distinct tumours, some of which had previously been carried in culture for over a year, through 25 successive passages.

It is apparent from these data that the autonomous, parasitic, and malignant behaviour acquired by the secondary tumours under the indirect influence of bacteria originally located in some distant part of the plant becomes an intimate function of the cells themselves, independent of any further external stimulation. These characteristics, not heretofore convincingly demonstrated in relation to plant tissues, are regarded as closely analogous to those of animal cancers, and the material at hand holds out great promise for the investigation of the fundamental cellular changes forming the biological bases of the 'cancer problem'.

Grieve (B. J.). **Mechanism of abnormal and pathological growth: a review.**—*Proc. roy. Soc. Vict.*, N.S., lv, 1, pp. 109–132, 1943.

Recent studies on the mechanism of abnormal and pathological growth in plants

are reviewed and critically discussed, with special reference to the effects induced by *Bacterium tumefaciens*, *Bact. solanacearum* [*R.A.M.*, xxi, p. 91], and *Rhizobium* spp. The hypothesis that indole-3-acetic acid, evolved by the pathogen in the plant, stimulates all proliferation or comparable processes is regarded as untenable, nor has it been conclusively shown that the physical presence of the bacteria leads to morbid reproductive activity through enhanced growth substance production. There are, however, strong indications that some growth substance mechanism operates in infected plants, and it is suggested that the crown gall problem, for instance, should be approached by an intensive study of the auxin and 'food factor' relationship in normal and diseased individuals.

THOROLD (C. A.). **Witches' broom disease investigations. V. Large-scale experiments on direct control.**—*Trop. Agriculture, Trin.*, xx, 9, pp. 176–181, 1943.

In further studies on the control of cacao witches' broom [*Marasmius perniciosus*: *R.A.M.*, xxii, p. 471], an experiment was carried out on River Estate, Trinidad (an area of severe incidence) in 1941–2 in which the brooms were removed over an area of about 80 acres between April and August; adjacent and surrounding fields totalling about 140 acres remained untreated. In the following year, the treated and untreated areas on this estate were reduced to 25 and 62 acres, respectively. The removal of the brooms began in March, 1942, and was completed by the end of May, and there was a second removal on 12 acres in November and December, 1942. A similar test was conducted in an area of moderate incidence, the Philippine Estate. Here the treated and surrounding untreated areas consisted of about 40 and 50 acres, respectively, in both seasons. Removal of brooms began in June, 1941, and was finished in the middle of August, 1941. There was a second removal in October and November, 1941. In the following year the removal of brooms began in March and was completed in April, and there was a second removal in October and November. In each experiment, 500 trees (treated and untreated) were kept under observation in both seasons.

In the first season, the results indicated that the large-scale clearances of brooms in the treated areas were effective in reducing disease incidence, both as regards broom and pod infection. Thus, on the River Estate, the mean number of brooms per tree was 103·1 and 181·1 for the treated and untreated areas, respectively, while the pod infection was 37·01 and 41·78 per cent., respectively. On the Philippine Estate the corresponding figures were 8·5 and 21·8 brooms and 7·89 and 24·21 per cent. pod infection. In 1942–3, however, the results obtained were negative, the figures for River Estate being 211·8 and 199·6 brooms per tree, and 24·40 and 13·38 per cent. pod infection for the treated and untreated areas, respectively, while on the Philippine Estate the figures were 12 and 13·6 brooms and 15·45 as against 16·61 per cent. pod infection.

These results do not support earlier observations (made on an area of under two acres) that a centre of infection may seriously affect the adjacent cacao for a distance of only about 100 yds. Also, they do not show that trees from which no brooms are removed have any harmful effect on neighbouring trees. It is, therefore, concluded that the removal of brooms is not effective in controlling the disease on areas of 25, 40, or 80 acres. Efforts at control should now be concentrated on the development of resistant types of cacao.

KÜTHE (K.). **Dauerhaftes Ausrotten der Berberitzensträucher zur Bekämpfung des Getreideschwarzrostes.** [Permanent eradication of Barberry bushes for the control of cereal black rust.]—*NachrBl. dtsch. PflSchDienst*, xxiii, 1, pp. 3–4, 1943. [Abs. in *Chem. Zbl.*, cxiv(i), 23, p. 2437, 1943.]

In the control of cereal black rust [*Puccinia graminis*] the application to the soil surrounding barberry bushes of sodium chloride at the rate of 50 gm. per sq. m.

sufficed to destroy them completely, the actual uprooting of the shrubs being superfluous.

SAUNDERS (A. R.). **Field experiments at Potchefstroom. A summary of investigations conducted during the period 1903–1940.**—*Sci. Bull. Dep. Agric. S. Afr.* 14, 138 pp., 40 figs., 4 graphs, 1942. Price 1*s.* 0*d.*

In this report a summarized account is given of the data accumulated from nearly 40 years' field experiments on plant-breeding at the Potchefstroom Experimental Farm, South Africa. On p. 14 it is stated that wheat varieties highly resistant to stem rust [*Puccinia graminis*] in other countries are often completely destroyed by the local forms of the disease [*R.A.M.*, xvii, p. 442]. Not only are there physiologic forms of *P. graminis* in existence which are peculiar to South Africa, there is also strong evidence that such forms of other diseases are present. The distribution of these forms is not uniform over the whole country, and a particular form does not show the same severity of attack in all areas. Maize dry rot (*Diplodia zeae*), for example, is present throughout the maize-growing districts, and is highly destructive in some localities, while never causing serious losses in others.

GOTTLIEB (D.) & HART (HELEN). **Growth substances and the rust fungi.**—*Phytopathology*, xxxiii, 8, pp. 724–728, 1943.

Experiments were performed to determine the possible relationship of the water-soluble growth substances, thiamin chloride, riboflavin, nicotinic acid, ascorbic acid, and beta-indole-acetic acid to the resistance of oats to four physiologic races of *Puccinia graminis avenae* and of wheat to seven of *P.g. tritici*. From the generally negative results the writers conclude that the vitamins in question do not play a major part in the reaction of these cereals to the two parasites tested, nor does it appear that pathogenic differences in physiologic races within a rust species are attributable to divergent growth substance requirements.

HOLTON (C. S.). **Chlamydospore germination in the fungus causing dwarf bunt of Wheat.**—*Phytopathology*, xxxiii, 8, pp. 732–735, 1 fig., 1943.

Chlamydospores of the race of *Tilletia tritici* [*T. caries*] responsible for dwarf bunt of wheat in Washington [*R.A.M.*, xx, p. 158] were induced to germinate by protracted immersion (upwards of three months) in tap water at 4° C., the maximum germination obtained by this method, however, being 30 per cent. Most of the germinating spores produced a promycelium with two to four branches, each bearing two to eight primary sporidia, some of which fused in pairs and usually gave rise to a mycelium, presumably the infection hypha. Relatively few sickle-shaped sporidia were formed. It is suggested that the type of structures produced by the germinating spores may in some way bear on the classification of the new race.

MUNDKUR (B. B.). **Karnal bunt, an air-borne disease.**—*Curr. Sci.*, xii, 8, pp. 230–231, 1 fig., 1943.

Wheat plants attacked by *Neovossia indica*, which has recently been shown not to be seed- or soil-borne [*R.A.M.*, xxii, p. 472], differ from those infected by *Tilletia caries* and *T. foetida* in the absence of dwarfing or change of colour and in the localization of the pathogen in five or six kernels of a head in place of its diffusion through an entire ear, as in the case of ordinary bunt. One or two of the infected kernels are entirely converted into smut balls, the others being only partially invaded. The mode of infection of the kernels being suggestive of transmission by the wind, experiments were conducted at Delhi in February and March and at Simla in April, 1943, to test the validity of the assumption that the light, falcate sporidia of *N. indica*, whorls of upwards of 150 of which are borne at the apex of the promycelial tubes, are wafted on to the ears in the 'anthesis' or 'dough'

stage. Moore's vacuum method of inoculating the ears was used [ibid., xv, p. 567]. In the Delhi series, all five infected ears of I[mperial] P[usa] 114 and two out of six of IP165 developed the symptoms of 'Karnal bunt', the corresponding figures for Simla being six out of 64 of IP165, 12 out of 54 of C591, and 20 out of 303 of IP125. The germination of the spores of *N. indica* is very erratic and the exact conditions governing its occurrence require further investigation, though it is evident that a very low temperature and a sufficient degree of humidity are essential. In 1942, when the disease was epidemic, 2·54 in. rain fell during the second half of January and 4·51 in. in February, as against traces and 0·15 in., respectively, in the corresponding periods of 1943, when the incidence was negligible.

Ogilvie (L.). **'Blighty Wheat', or the blackening of Wheat ears.**—*Rep. agric. hort. Res. Sta. Bristol, 1942*, pp. 83–88, [1943].

Blackening of the ears of wheat, sometimes referred to by English farmers as 'blighty wheat', is stated to be caused by the fungi *Erysiphe graminis*, *Cladosporium herbarum*, *Alternaria* spp., and to a lesser extent *Septoria nodorum*. Severe incidence may be brought about in a wet season by a complex of factors, of which low potash status and lack of ventilation are the most important. Observations made in 1942 in Somerset, Wiltshire, Gloucestershire, and Worcestershire showed that low values of available potash in the soil were associated with the worst discoloration of the ears. It was found in variety trials that the tall-growing varieties tended to become 'lodged' and to develop subsequently very severe blackening of the ears, while short varieties retained their ears clean, probably owing to greater ventilation. The relatively resistant varieties were also the first in the order of ripening. Top-dressing of nitrogenous fertilizers may tend to encourage fungal infection and subsequently blackening of the ears by upsetting the nitrogen/potassium balance in potash-deficient soils, by delaying ripening, and by producing a leafy growth, which impedes proper ventilation.

Honecker (L.). **Erfahrungen und Beobachtungen über das Auftreten des Gerstenflugbrandes und über die Wirkung verschiedener Verfahren zu seiner Bekämpfung.** [Experiments and observations on the occurrence of Barley loose smut and on the effect of various processes on its control.]—*Prakt. Bl. PflBau*, xix, pp. 186–201, 1941–2. [Abs. in *Zbl. Bakt.*, Abt. 2, cv, 23–24, 1943.]

In order to minimize the risk of injury to barley seed-grain by the hot-water treatment against loose smut [*Ustilago nuda*], a method was devised involving two hours' immersion at 45° C. in a 0·075 to 0·1 ceresan solution, followed by an instantaneous dip in a cold solution of the same, and then by gradual drying. The new process was experimentally shown to be almost equally effective with the hot-water treatment and caused less delay in germination, while it stimulated the vigour of the plants.

Honecker (L.). **Aufgaben der Pflanzenzüchtung in der Kriegs- und Nachkriegszeit.** [Functions of plant breeding in the war and post-war periods.]—*Prakt. Bl. PflBau*, xix, pp. 142–164, 1941–2. [Abs. in *Z. PflKrankh.*, liii, 1–3, pp. 142–143, 1943.]

Among the current problems confronting German plant-breeders is the development of resistance to disease. In barley, for example, by means of hybridization resistance to yellow rust (*Puccinia glumarum*) and mildew (*Erysiphe graminis*) has been combined in certain forms, which are now in the hands of private breeders; but the development of immunity from dwarf rust (*P. simplex*) [*P. anomala*] presents greater difficulties, owing to the existence of so many biotypes within the species. However, crosses with resistant four-rowed summer barleys of South

American origin have produced two-rowed resistant forms which are now being back-crossed with yellow rust- and mildew-resistant malting varieties.

Castronovo (Ada M.). **La biología de 'Puccinia rubigo-vera secalis' en la República Argentina.** [The biology of *Puccinia rubigo-vera secalis* in the Argentine Republic.]—*Rev. argent. Agron.*, x, 3, pp. 244–249, 2 pl., 1943.

From the results of inoculation experiments conducted in Argentina from 1941 to 1943, it is concluded that *Lycopsis arvensis* is an aecidial host of rye rust (*Puccinia rubigo-vera secalis*) [*P. secalina*: *R.A.M.*, xxi, p. 518]. It was experimentally shown that the teleutospores of the fungus need no preliminary resting period for germinating, and that they germinate with difficulty after three months' storage in the herbarium, their germinating capacity decreasing with increasing age.

Pathology and mycology of Corn.—*Rep. Ia agric. Exp. Sta., 1940–41,* Part II, pp. 54–58, 1 fig., [? 1941].

In this report [cf. *R.A.M.*, xx, p. 357], I. E. Melhus states that during the summer of 1940 maize smut (*Ustilago zeae*) reached epidemic proportions in Iowa, infection being favoured by the dry conditions prevailing in spring and early summer. It was ascertained that the severity of gall production on a line of maize was closely related to the percentage of infection. The severity of infection obtained with a sporidial suspension was greater when it was diluted with carrot decoction than with distilled water, greater with triethanolamine oleate as a spreader than with fish-oil soap, and greatest when the suspension was hypodermically injected into susceptible tissues. Under controlled environmental conditions, the extent of gall formation was increased by moderate wilting of the plants when they were exposed to infection, decreased by the presence of water in the leaf whorl or by exposure for 80 hours at 38° C., and inhibited by a combination of wilting and exposure for 96 hours at 38°.

In tests to ascertain the conditions for the production of a good supply of spores of *Diplodia zeae* with a high percentage of germinability, a medium consisting of a water extract of maize meal or oatmeal proved the best. Spore production was greatest at 20° in the light. Spores generally had a much reduced germinability when pycnidial formation was abundant. They appeared to lose their germinability within 14 to 21 days after pycnidial formation. In a study of the root-infecting activity of *D. zeae* on maize under field conditions, partial disinfection of the soil was carried out with formaldehyde at the rate 10 oz. (diluted 1 : 1,000) per 100 sq. ft. The soil was infested by introducing a maize meal-sand culture at the rate of about 50 gm. per 5 ft. row. There was a decrease of 1·8 to 4·5 per cent. in stand count, top growth, and root length of the maize seedlings in the infested soil as compared with the non-infested. In a greenhouse test the corresponding decrease was 15 to 45 per cent.

G. Semeniuk, C. S. Reddy, I. E. Melhus, W. E. Loomis, E. W. Lindstrom, and G. F. Sprague found that premature stalk-dying of maize due to *D. zeae* during 1940 was favoured by wet weather in August. In the first two weeks of September individual maize fields showed from nearly zero to 35 per cent. prematurely dying stalks, with more occurring on the high than in the low places. One field on 23rd October showed 80 per cent. dead stalks, of which 13 per cent. were broken over near the ground. In this field, the ears on the dead stalks averaged 23·7 per cent. less weight than those from green stalks.

In greenhouse tests to develop a suitable technique for utilizing the seedling stage in estimating maize resistance to *D. zeae*, inoculum placed at the seed-level was found to be more injurious to the developing seedlings than inoculum placed 2 or 4 cm. below seed-level.

The report concludes with a brief review by I. E. Melhus, C. S. Reddy, R. H. Porter, and G. Semeniuk of the prevalence, distribution, and losses caused by plant diseases in Iowa during the period under review.

Chilton (S. J. P.). **A heritable abnormality in the germination of chlamydospores of Ustilago zeae.**—*Phytopathology*, xxxiii, 9, pp. 749–765, 1 fig., 1 diag., 1943.

Chlamydospores from certain crosses between monosporidial lines of maize smut (*Ustilago zeae*) were observed to germinate abnormally, giving rise to gnarled and misshapen promycelia that either autolyse before producing sporidia or form only a few of these organs in an irregular manner. The one or more factors for lysis, which was conclusively shown not to be due to an infectious agent of the bacteriophage type, are carried only by certain lines, and segregation for such factors was demonstrated by an appropriate series of crosses. The operation of the factors governing lysis and its associated abnormalities appears to be restricted to the period of meiosis. The promycelia of chlamydospores arising from crosses involving one or more haploid lines carrying the lysis factors displayed a tendency to produce exceptionally large numbers of solopathogenic, apparently diploid sporidia. The solopathogenic lines made normal growth, caused infection on inoculation singly into maize plants [*R.A.M.*, xi, p. 363], and were subject to mutation in the same way as haploid ones. Partial reversion to the normal type of germination occurred in the chlamydospores produced by some solopathogenic lines, as indicated by a decrease in the percentage of abnormal and disintegrating promycelia, and was shown by crosses between the resultant haploid sporidia to persist. As in the case of *Sphacelotheca sorghi*, a correlation was established between abnormally large chlamydospore dimensions and an aberrant form of germination [cf. ibid., xx, p. 299].

Brichet (J.). **Production d'Agrumes 1942–1943 réduite par une météorologie défavorable et une culture déficiente ou intempestive. Le die-back, sa génèse, ses manifestations, ses conséquences.** [Citrus production in 1942–1943 reduced by unfavourable weather and a defective or inopportune system of cultivation. Die-back, its genesis, its manifestations, its consequences.]—*Fruits & Primeurs*, xiii, 132, pp. 10–11, 1943.

Adverse weather conditions, coupled with inappropriate methods of cultivation, are stated to have been responsible for a decline in French Moroccan orange production in 1942–3, the latter factor being largely conditioned by war-time restrictions in the supply of fertilizers, machinery, and other facilities. Neglected or improperly treated trees are liable to suffer from die-back, characterized by withering of the branch tips, sometimes accompanied by gummosis, and cracking of the fruits [cf. exanthema; *R.A.M.*, xxii, p. 241]. The margins of the fissures rapidly harden, and the exposed flesh coarsens, loses its sugar and acidity, and also becomes more or less deeply ruptured. Affected fruits fall to the ground where they become attacked by the green and blue moulds (*Penicillium digitatum* and *P. italicum*), which spread to the healthy oranges.

Control should be based on a readjustment of the cultural technique designed to restore the essential vegetative equilibrium. In addition to these general hygienic precautions, American citriculturists have successfully employed a specific dormant treatment consisting in the application of Bordeaux mixture at normal strength, which exerts a highly stimulatory action on the trees and frequently effects a rapid cure, besides controlling the blue and green moulds. Another method involves the incorporation with the soil under the trees of finely ground copper sulphate at a dosage not exceeding 40 to 50 gm. per sq. m. There is, however, a serious risk of injury to copper-treated trees in the event of subsequent

treatments (within the next six months) against scale insects with hydrocyanic acid.

TURRELL (F. M.), CUNEO (F.), SLACK (D.), & CARNS (H.). **Factors in injury to Citrus by sulphur dusts.**—*Calif. Citrogr.*, xxviii, 11, pp. 286–287, 302, 306–307, 310–311, 4 figs., 2 diags., 4 graphs, 1943.

This is a progress report of laboratory and field studies of the physiology of sulphur injury to citrus fruit, conducted, mainly on lemons, at the California Citrus Experiment Station since 1939. Observations showed that the solid sulphur particles on the surface of dusted fruit volatilize at high temperatures and the gas penetrates the fruit rind. Two reactions occur when gaseous sulphur enters the protoplasm: (1) sulphur is reduced to hydrogen sulphide, and (2) sulphur is oxidized to sulphate. Hydrogen sulphide is produced in larger quantities in the spring than in the summer; its production, per unit of time, increases rapidly with temperature rising from 90° to 120°, and its total production increases up to 115°, and then decreases with further rise in temperature. The gas is capable of penetrating the rind and injuring the citrus fruit, but it has not been ascertained whether it is the causal agent in sulphur burns or only a by-product indicative of an injurious preliminary reaction. The gas does not influence the vitamin C content of the fruit. One of the principal environmental factors influencing sulphur injury is the intensity of sun radiation received and undissipated by citrus fruit by re-radiation or by conduction. High relative humidity, warm air, and lack of air movement are secondary factors influencing sulphur injury.

TURRELL (F. M.), SOKOLOFF (V. P.), & KLOTZ (L. J.). **Structure and composition of Citrus leaves affected with mesophyll collapse.**—*Plant Physiol.*, xviii, 3, pp. 463–475, 1 col. pl., 1 map, 1943.

Mesophyll collapse of citrus [*R.A.M.*, xx, p. 111] is stated to occur in the coastal regions of all southern California, being largely confined to leaves of orange trees and rarely found in those of lemons. The affected leaves have chlorotic, translucent areas, appearing water-soaked, chiefly but not exclusively in the central portion of the blade; brown, necrotic spots may develop in the translucent areas. Histological examination of affected leaf tissue showed enlarged sponge cells interspersed with collapsed ones, reduced intercellular spaces, and chlorophyll-depleted spongy mesophyll cells. Collapsed tissue invariably contained less calcium and somewhat more potassium, magnesium, nitrogen, chloride, and phosphorus than did normal tissue. The ratio of calcium to potassium was accordingly lower in the collapsed than in the normal tissue. Distribution of the alkaline-earth and alkali bases between the sap and the solid parts of autoclaved leaf tissue also showed similar differences in absolute and relative amounts of calcium and potassium. There was no consistent difference in the sulphur content of collapsed and normal tissue, but the former consistently contained lower percentages of sulphate ion ash than did the latter, while the carbon content (expressed in terms of CO_3) was the same in both.

KAR (P. C.) & SAHA (J. C.). **Controlling fruit scab of Pomelo, Citrus grandis Osbeck (=C. decumana Linn.)** —*Sci. & Cult.*, viii, 10, pp. 422–423, 1 fig., 1943.

A severe attack of scab (*Sphaceloma fawcettii*) [*Elsinoe fawcetti*] in the pomelo (the thick-skinned shaddock as opposed to the thin-skinned commercial grapefruit) plantations of the Agricultural Research Station, Dacca, Bengal, was effectively combated by two applications, with an interval of a fortnight, of 5–5–100 Bordeaux mixture plus 0·5 per cent. resin.

FREZZI (M. J.) & MÁCOLA (T.). **'Phytophthora palmivora', causante de la 'podredumbre morena' de los frutos cítricos en Córdoba (Argentina).** [*'Phytophthora palmivora'*, the agent of 'brown rot' of Citrus fruits in Córdoba (Argentina).]—*Rev. argent. Agron.*, x, 3, pp. 227–230, 1 pl., 1 fig., 1943.

Phytophthora palmivora was isolated from brown rot of navel orange and lemon fruits in the province of Córdoba, Argentina. Although previously recorded in that country [*R.A.M.*, xx, p. 401], it has not hitherto been associated there with brown rot of citrus. The authors describe the morphological and cultural characters of the fungus, the identity of which was confirmed by Dr. J. T. Middleton and Dr. H. S. Fawcett. In pathogenicity tests, inoculation with cultures of the fungus resulted in infection of unwounded fruits of sweet orange and lemon, while wound inoculations of stems, collars, and fruits gave infection of peach and apple, but not of sweet orange.

BLISS (D. E.). **The spread of Omphalia root rot by offshoots of the Date Palm.**—*Rep. Date Grs' Inst., 1943*, pp. 3–5, 1 map, [1943].

The present situation regarding the *Omphalia* root rot of dates (*O. pigmentata* and *O. tralucida*) [*R.A.M.*, xix, p. 591] in the Coachella Valley of California is summed up as follows. Of the 25 orchards in which the disease has been definitely identified, seven have been freed from it by means of soil fumigation with carbon disulphide, while 13 others are stated to represent a serious problem for the entire date industry of the valley, as much propagating material has been taken from them before the nature of the disease has been discovered. The remaining five orchards have small infested areas of one to ten tree spaces which remain in a more or less static condition and which could, therefore, be easily fumigated. Three further orchards are suspected of having areas of infested soil, which might become dangerous should they be replanted with susceptible palms. The author considers that the opportunity for complete eradication of the disease from the valley has already passed. Its spread, however, may be limited by the following means. Replanting with dates should be avoided except where the former plantings are known to have been free from infection, or where the soil has been fumigated. Great care should be taken in selecting disease-free offshoots for propagation, taking them only from healthy palms, and avoiding all within ten tree rows from the closest infected area. It is suggested that prospective buyers should be allowed to select their planting stock directly from the palms, that the movement of offshoots should be recorded for future reference, and that palms known to have originated from infested orchards be held under observation for a period of at least six years after planting.

HARROLD (T. J.). **Histological studies of infections of the Cotton hypocotyl by Glomerella gossypii and Fusarium moniliforme.**—*Phytopathology*, xxxiii, 8, pp. 666–673, 5 figs., 1943.

In inoculation experiments on College No. 1 cotton seedlings in water-agar cultures in Petri dishes, *Glomerella gossypii* and *Fusarium moniliforme* [*Gibberella fujikuroi*] pursued similar courses in respect of penetration and mode of development in the host, both acting as intracellular parasites which eventually destroy the host cells. Features of infection by the two fungi include necrosis of the cortex and stele, enlargement of the hypocotyl above the site of invasion, and lateral flattening of the same region at the point of entry of the pathogens. There were, however, several differences between the effects induced by the two parasites. For instance, the hypocotyls attacked by *G. fujikuroi* attained a length of up to 5 in., equal to that of the controls, while those in the *Glomerella gossypii* series reached only 1 in.; the former fungus produced less external mycelium than the latter; and the seedlings infected by *Gibberella fujikuroi* commonly developed

a whorl of lateral roots at the area of ingress, which may account for the stronger tendency to survival in the hosts of this organism than in those harbouring the agent of anthracnose.

De Meillon (B.) & Muspratt (J.). **Germination of the sporangia of Coelomomyces Keilin.**—*Nature, Lond.*, clii, 3861, p. 507, 1 fig., 1943.

Germination was induced in sporangia of *Coelomomyces* [cf. *R.A.M.*, iv, p. 85] found in a larva of a species of *Mucidus* in Northern Rhodesia. When about to germinate a sporangium loses its oil droplets and becomes granular; a slight bulge appears on one side, gradually enlarging and rupturing the outer hard wall, two thin membranes becoming visible, into which the contents of the sporangium flow out. This stage is reached in one to two days. After this, within a few minutes, the two inner membranes become more widely separated, the hitherto closely packed zoospores come to life and are rapidly liberated until the whole sporangium is emptied. During the last stage, the thin membranes appear to remain intact, suggesting that the spores are capable of penetrating without rupturing them. A zoospore measures about 4 μ, and its flagellum is about four times that length.

Ogloblin (A.) & Jauch (Clotilde). **Reacciones patológicas de los Acridios atacados por 'Aspergillus parasiticus'.** [The pathological reactions of the Acrididae attacked by *Aspergillus parasiticus*.]—*Rev. argent. Agron.*, x, 3, pp. 256–267, 4 pl., 2 figs., 1943.

It was observed at the insectary of the Locust Research Institute at José C. Paz, Argentina, that some Acrididae (*Schistocerca cancellata, Dichroplus arrogans*, and *D. elongatus*) were frequently fatally attacked by a fungus identified in culture as *Aspergillus parasiticus* [*A. flavus*: *R.A.M.*, ix, p. 766; xi, p. 696]. The identification was confirmed by K. B. Raper, Illinois. The fungus was also observed to subsist saprophytically in nature.

Positive results were obtained in inoculation experiments by placing both insects and spores in chambers with a relative humidity of 70 to 90 per cent. and a temperature of between 30° and 35° C., the spores being blown about in the air by an artificially induced air current. The respiratory channel appears to be the normal means of penetration and the larvae are better adapted to defend themselves from infection than the adult insects, since the entire cuticular lining of the respiratory system is changed during the moult. In the adult insect, the chief means of defence is phagocytosis, primary capsules being formed at the point of entry of the fungus into the tracheal tubes and air sacs. At a later stage, dead matter becomes detached from these foci of inflammation and floats away, giving rise in time to secondary capsules in the body cavity. The fungus invades all tissues of the insect without distinction, but the hyphae are denser in the proximity of the air passages, indicating the great dependence of the fungus on supply of oxygen, a need which is also apparent from its behaviour in culture.

Holloway (J. K.) & Young (T. R.). **The influence of fungicidal sprays on entomogenous fungi and on the purple scale in Florida.**—*J. econ. Ent.*, xxxvi, 3, pp. 453–457, 1943.

In Florida opinion expressed in published papers and verbal reports is not agreed upon the cause of the increase of scale insects following the use of a fungicide. It is attributed by some chiefly to the elimination of the fungi, by others to the inert granular residue from the spray, and by others again to a combination of both factors. The first improved roads in the State were shell- or clay-surfaced and trees bordering such roads were more heavily infected with scales than those farther away; road dust and inert granular residue from sprays were in time proved to be definite factors in scale increase.

In an experiment designed to contrast the influence of inert residues and copper fungicides on the purple scale [*Lepidosaphes beckii*] and two of its most important fungus parasites, *Nectria diploa* and *Sphaerostilbe aurantiicola* [*R.A.M.*, xxii, p. 205], the inert residues were found to be chiefly responsible for the increase of scale following the treatments. The copper fungicides reduced infection of the scale by entomogenous fungi, but the reduction caused no significant difference in scale mortality or in the total infestation. A year after the application of the sprays there was still no significant difference in total infestation attributable to use of copper sprays. The two high-residue treatments had still the highest total infestation. No increase in the percentage of scale infection by entomogenous fungi was secured by the application of a spray of fungus spores.

Benedek (T.). **Unilateral stimulation of Microsporum audouini by a new species of Bacillus.**—*Mycologia*, xxxv, 2, pp. 222–242, 7 figs., 1943.

After pointing out that he has confirmed Conant's observation that *Microsporum audouini*, unlike all other known species of the genus, does not grow on rice medium, the author gives a detailed account of investigations on a new mustard-yellow, pigment-producing, spore-bearing organism, named *Bacillus weidmaniensis* n.sp., found in the primary culture of a strain of *M. audouini*, the evidence indicating unilateral vital stimulation between the two organisms. In the presence of *B. weidmaniensis, M. audouini* did grow on rice medium, in some cases producing perfect perithecia. The bacillus is fully described.

Caldwell (S. A. G.). **Flax crop and fibre quality.**—*Text. Manuf.*, lxviii, 808, pp. 168–170, 1 fig., 1942.

In connexion with the extension now proceeding in the British flax-growing industry, the need for stringent precautions against seed-borne disease is strongly emphasized, and the symptoms and life-cycles of the principal fungi transmitted in this matter, viz., rust and firing (*Melampsora lini*) [*R.A.M.*, xxii, p. 310], browning or stem-break (*Polyspora lini*), seedling blight (*Colletotrichum lini*) [*C. linicola*], and wilt (*Fusarium lini*) are described in semi-popular terms. Observations are also made on two nonparasitic disorders, one known as 'yellowing' and liable to confusion with the early stages of seedling blight, and the other as 'droop': the former is probably due to deficiency of potash, the inclusion of which in the fertilizer was found to cure the trouble. Plants affected by 'droop' somewhat resemble those attacked by *F. lini* and usually occur in patches. The fibrous systems of the affected stems are more or less disorganized, the cell walls being swollen and often partially dissolved; the part just above the diseased area dies, while below it stem growth and fibre development proceed normally. Although the damage inflicted on the growing crop by 'droop' is not substantial, most of the fibres are broken off in the subsequent dressing operations and the yield of tow thereby increased. Three fungi are associated with the dead stalks commonly present in the growing crop and yielding a dark, flat, ribbon-like, weak fibre, namely, *Botrytis* [*cinerea*], *Phoma* sp., and *F. lini*.

Vanterpool (T. C.). **Flax diseases.**—*Agric. Ext. Bull. Univ. Saskatch.* 110, 4 pp., 5 figs., 1943.

Notes are given in tabular form on the symptoms and prevention of the chief diseases of flax found in Saskatchewan, followed by brief, practical instructions for the reduction of losses caused by flax diseases in general.

Newhook (F. J.). **Pasmo (Sphaerella linorum) on Flax in New Zealand.**—*N.Z.J. Sci. Tech.*, A, xxiv, 2, pp. 102–106, 3 figs., 1942.

During the season of 1941–2, *Sphaerella linorum* was observed on linen flax

crops at Auckland, Masterton, and Wanganui, but was not detected in a survey of four districts of South Island in January, 1942. Wild flax (*Linum marginale*) [*R.A.M.*, xxii, p. 126] was severely infected in North Island in December, 1941, and January 1942, but at the date of inspection (8th to 13th January), commercial crops at Blenheim and Rangiora were free from the disease, notwithstanding the presence in some fields of the wild host. In greenhouse inoculation experiments on 300 linen flax plants with a spore suspension of the fungus from diseased cotyledons of *L. usitatissimum*, many typical foliar lesions developed in nine days, the stems showing infection after 26 days, and most of the plants being killed by the end of a month. The pathogen was recovered from the diseased material. Spore suspensions of *S. linorum* from *L. marginale* were likewise pathogenic to linen flax.

In tests with hot water (127° F.) and four dusts, only the former gave effective control of seed-borne infection in the Liral Crown variety (ten minutes' immersion), the number of foliar lesions being reduced from 359 to 59; the average for the four dusts was 183.

In retting and scutching experiments on Concurrent linen flax in 1942, the percentages of line fibre obtained from clean, moderately infected, and severely infected plants were 88, 67·9, and 61·8, respectively.

Kar (P. C.) & Saha (J. C.). **A new stem-base disease of Altissima caused by a species of Phytophthora.**—*Curr. Sci.*, xii, 8, pp. 229–230, 1943.

The species of *Phytophthora* responsible for the stem-base rot of roselle hemp (*Hibiscus sabdariffa* var. *altissima*) in Bengal, first reported in 1931 [*R.A.M.*, xi, p. 158], is characterized on potato dextrose agar by ovoid sporangia, 19·2 to 48 by 18 to 33·6 μ, 'with papilla 4·8 to 7·2 μ', and hyphae 4·8 to 9·6 μ in width. Infection usually originates near the collar region, but the brown, shrivelled lesions, $\frac{1}{2}$ to several cm. in length, intersected by fissures revealing the underlying pith may extend 2 to 3 ft. upwards from soil-level. Under the very humid conditions favouring the pathogen gum may be observed to proceed from the older, coalescent lesions. The diseased stems may be partially or entirely girdled, the foliage wilts, and the plants become desiccated and die prematurely. Considerable damage is caused by the stem rot to the valuable, silky fibres of roselle hemp, which is used commercially in the manufacture of ropes, cordage, and the like. Further studies on the organism and its control are in progress.

Hannibal (L. S.). **Mosaic virus in the Amaryllids.**—*Herbertia*, ix, pp. 149–150, 1942.

The writer's attention was recently called to the presence in *Crinum*, *Amaryllis*, and *Hymenocallis* of mosaic disease, which is prevalent, especially in southern California, on the Minister Talma and Bernardino varieties and *triandrus* hybrids of *Narcissus*. The examination of about 140 Amaryllids representing 30 or more genera revealed varying degrees of infection in *Amaryllis rutila* var. *fulgida*, *H. johnsonii*, *H. solandriflora* var. *conspicua*, *A. regina*×*A. fulgida*, *A. aulica*, *A. belladonna*, *Crinum gigantea*, *C. imbriaticum*, *H. occidentalis*, *H. pauciflora*, *H. tenuiflora*, *Urceolina peruviana*, and others.

Grieve (B. J.). **Further observations on Rose wilt virus.**—*Proc. roy. Soc. Vict.*, N.S., liv, 2, pp. 229–238, 2 pl., 1 fig., 1942.

The writer's studies at the University of Melbourne on the morbid anatomy of rose plants infected by the wilt virus [*R.A.M.*, x, p. 733] revealed cellular necrosis in the cortex, medullary rays, and phloem of the canes from the stage of reflexing of the leaflets to their defoliation. The pathological process was shown by microchemical tests to be accompanied by suberization of the walls and the secretion

of a gummy substance. Spherical or oval intracellular bodies were detected in proximity to the nucleus in leaves remaining attached to the plant for some time, but in most cases the leaves absciss shortly after reflexing takes place and before the development of lesions.

The comparative difficulty experienced in the transmission of the rose wilt virus by mechanical means and its serological inactivity strongly suggest its inclusion in the group of viruses characterized by instability *in vitro*. Out of 20 plants T-budded with diseased buds only four effected a union, and of these two successfully transmitted the disease. The controls remained healthy. The analogies between rose wilt and Gigante's virus disease in Italy [ibid., xvi, p. 179] are sufficiently close to point to the identity of the agents, but further comparative investigations are necessary to establish this hypothesis.

Control should be based on general hygienic precautions and the exclusion from local gardens of the susceptible Pernetiana, Hybrid Tea, and Hybrid Perpetual groups.

Creager (D. B.). **Carnation mosaic.**—*Phytopathology*, xxxiii, 9, pp. 823–827, 2 figs., 1943.

The form of carnation mosaic prevalent in Illinois greenhouses is characterized by mottling and streaking of the foliage and breaking of the flowers in coloured varieties, and is believed to be similar to, if not identical with, a trouble previously reported under the name of 'yellows' from the United States (*Circ. N. J. agric. Exp. Sta.* 385, p. 71, 1939), a suspected virus disease in England [*R.A.M.*, xvii, p. 52], and carnation mosaic in Japan [ibid., xvii, p. 506]. Earlier records, however, have furnished no conclusive evidence of the virus origin of the disease, which was secured in the writer's experiments, involving the grafting on 215 healthy King Cardinal plants of infected scions of the same variety and Pink Treasure. Out of the first series of 110 plants, 91 successful grafts were obtained, while the second series of 105 yielded 101. In the former series, 90 of the plants resulting from the 91 effective unions showed definite foliar symptoms, while all the 32 that flowered bore typically broken and distorted blossoms. In the latter experiment, which is still in progress, 78 out of 101 positive grafts have so far developed leaf mottling and flecking, while 20 have produced broken flowers. The 100 ungrafted controls all remained healthy. The infective principle was further shown to be perpetuated through cuttings from diseased plants, and to be disseminated in the field from infected to healthy individuals, probably by means of insects.

Creager (D. B.) & Boewe (G. H.). **Peony anthracnose found in Illinois.**—*Plant Dis. Reptr*, xxvi, 12–13, pp. 280–281, 1942. [Mimeographed.]

In 1941, the authors observed a disease of peonies of the true anthracnose type [cf. *R.A.M.*, xix, p. 541] in three widely separated commercial plantings in southern Illinois. The disease recurred a year later in the same plantings. The affected varieties were Couronne d'Or, Karl Rosenfield, Sarah Bernhardt, William Penn, and Alsace Lorraine, the first-named being the most severely attacked. The disease caused conspicuous reduction in the yield and quality of flowers, complete destruction of the stems, and sometimes the death of entire plants. The stem lesions ranged from small, elongated, reddish spots, which enlarged into lesions with greyish centres and reddish borders, to extensive zonate cankers. Cankered stems were commonly twisted, bent, or curled and infected leaves were often curled and puckered. The buds were blasted when the bud scales and outer petals became infected. A fungus resembling *Gloeosporium fructigenum* [*Glomerella cingulata*] was associated with the lesions. Inoculations of Couronne d'Or plants in the greenhouse with the fungus taken from diseased peonies gave rise to typical

symptoms in apparently unwounded as well as wounded stems and leaves, though similar inoculations with *G. cingulata* from apple fruit lesions failed.

SEVERIN (H. H. P.). **Breaking in color of flowers of annual Phlox caused by the Aster-yellows virus.**—*Phytopathology*, xxxiii, 8, pp. 741–743, 1 fig., 1943.

Annual phlox (*Phlox drummondii*) in the Montara mountains, California, showed both breaking in flower colour and symptoms of aster yellows, which was conveyed to healthy asters by the leafhopper, *Macrosteles divisus* [*R.A.M.*, xxii, p. 206]. Conversely, the aster yellows virus was transferred from celery to phlox by the same agency and caused breaking in the colour of the petals, the symptoms including white veinbanding, virescence, and proliferation of the flowers; in advanced stages the petals are reduced to green leafy structures resembling sepals, sometimes with a dwarfed apical flower lacking one or more petals, while clusters of green flowers frequently develop without proliferation. This is stated to be the first case of a leafhopper-transmitted virus inducing breaking in flower colour.

WHITE (H. E.). **Breeding Snapdragons for resistance to rust.**—*Bull. Mass. agric. Exp. Sta.* 400, 16 pp., 2 figs., 1943. [Abs. in *Exp. Sta. Rec.*, lxxxix, 4, p. 448, 1943.]

Improved strains of *Antirrhinum* [*majus*] highly resistant to rust [*Puccinia antirrhini*] were derived from crosses between greenhouse forcing types and resistant selections developed at the Indiana Agricultural Experiment Station. Resistance was shown to be inherited as a simple dominant factor [*R.A.M.*, xv, p. 228]. A modified dominant type of resistance was observed, moreover, in 80 to 90 per cent. of the progeny arising from crosses between susceptible commercial varieties, which were also suitable in colour and growth habit for greenhouse cultivation. The most resistant of the 56 wild *A.* species and strains tested for reaction to *P. antirrhini* were *A. charidemi*, *A. calycinum*, *A. ibanjezi*, *A. siculum*, and four strains of *A. glutinosum*. Plants propagated from cuttings resisted the disease for three seasons in field and greenhouse trials. No physiologic races of the rust were detected on the resistant hybrids.

WILHELM (S.). **Observations on the bacterial crown, stem, and bud rot of Delphinium.**—*Phytopathology*, xxxiii, 9, pp. 806–811, 2 figs., 1943.

Excessive soil moisture was shown by recent investigations in California to be highly conducive to the development of perennial *Delphinium* crown rot and stem and bud rot of rocket larkspur (*D. ajacis*) caused by *Erwinia phytophthora* [*R.A.M.*, xvii, p. 605], the incidence of which may be substantially reduced by sparing irrigation in furrows at a distance from the rows, and by planting on low ridges. The period of flower-spike elongation is the critical juncture for infection in both the perennial and larkspur types, presumably owing to the formation at this time of deep cracks in the stem bases. Since the pathogen may persist in the soil in a state of extreme virulence at least from one planting cycle to the next, crop rotation is advisable. The disease, though distinctly more troublesome in the summer months, may also become destructive during the winter. The most susceptible varieties of *D. ajacis* in field plantings are The Dazzler, Miss California, Lilac King, Stock Flowered Dark Blue, Blue Bell, Super Majestic Rose, Lustrous Carmine, and Los Angeles, whilst the Belladonna group of perennials, the native Californian *D. cardinale*, *D. hesperium*, *D. parryi*, and *D. scopulorum* var. *glaucum* are all subject to severe infection, and the Pacific Giant Hybrids and the English hollyhock, Blackmore, and Langdon strains of *D. elatum* are susceptible. On the other hand, *D. chinensis* (*grandiflorum* group) and the spurless *D. cinereum* and *D. tatsienense* appear to be highly resistant in the field.

BAKER (K. F.) & CUMMINGS (KATHARINE). **Control of Pythium root rot of Aloe variegata by hot-water treatment.**—*Phytopathology*, xxxiii, 8, pp. 736–738, 1 fig., 1943.

Pythium ultimum is the agent of a commercially important root rot of nursery plants of *Aloe variegata* in California, where it has hitherto been customary to discard infected material at considerable loss. This may be obviated by immersion of the plants for 20 to 40 minutes (according to size) in water heated to 46° C., which destroys the pathogen without injury to the host. The treated plants may be replanted in clean soil.

SPRAGUE (R.). **The genus Phaeoseptoria on grasses in the western hemisphere.**—*Mycologia*, xxxv, 4, pp. 483–491, 2 figs., 1943.

The author provides a key to segregate *Phaeoseptoria* from certain other genera of the Sphaeropsidales and discusses seven species of this genus on grasses, including three new to science, and four new combinations.

KREITLOW (K. W.). **Ustilago striaeformis. I. Germination of chlamydospores and culture of forma agrostidis on artificial media.**—*Phytopathology*, xxxiii, 8, pp. 707–712, 1 fig., 1943.

The chlamydospores of a collection of *Ustilago striaeformis* f. *agrostidis* from two plants of *Agrostis alba* [*R.A.M.*, xv, p. 29] in a Pennsylvanian pasture germinated in tap and distilled water at room temperature without an after-ripening period. Germinability varied among individual chlamydospores originating in an identical sorus or in different sori on the same plant. Momentary treatment of the spores with 95 per cent. ethyl alcohol caused almost instantaneous collapse, but turgidity was regained in water and no permanent damage resulted, whereas exposures of 15 to 30 seconds' duration completely inhibited germination. The chlamydospores withstood several minutes' immersion in di-ethyl ether and survived for at least 30 days in storage at 10° C., though germinability was reduced from 75 to under 10 per cent. under these conditions. Monochlamydospore cultures of the newly discovered collection (14A) of the smut were grown on potato dextrose agar, on which the minimum, optimum, and maximum temperatures for the resultant strictly mycelial form of development were 5°, 20° to 25°, and below 35°, respectively. The colonies fell into two distinct biotypes, one flat and lustrous and the other fluffy and raised, the colour of both being pale buff.

GRIFFITH (R. B.). **A leaf disease of Kentucky Bluegrass.**—*Phytopathology*, xxxiii, 8, p. 745, 1943.

Since 1940 *Septoria oudemansii* has been isolated fairly consistently from Kentucky bluegrass (*Poa pratensis*), which is subject during cool, wet weather, especially in the spring, to a yellowish-brown discoloration involving entire fields and lawns, a recurrence of infection in the autumn frequently being observed. The injury originates on the leaf sheath, through which it may spread to the young leaves or tissues within, eventually killing all the leaves of a shoot. Under somewhat drier conditions, small, dark brown spots may appear on the leaf blades and sheaths. The disease may be responsible for semi-complete defoliation. The pycnidia of the fungus, which are commonly found on dead leaf blades, contain continuous, rarely uni- to biseptate, hyaline spores, 14·5 by 2·5 μ. On potato dextrose agar at 15° C. black, stroma-like bodies were produced in which the pycnidia were embedded. The application of cotton blue to sections of infected foliar tissue showed the organism to be intercellular. Although the occurrence of *S. oudemansii* on *P. pratensis* has been reported from Michigan, Oregon [*R.A.M.*, xxi, p. 493], and the western United States, its importance as a pathogen of bluegrass does not appear to have been previously recognized.

Hollowell (E. A.). **Registration of varieties and strains of Red Clover, I.**—*J. Amer. Soc. Agron.*, xxxv, 9, pp. 830–833, 1943.

The two first red clover varieties to be registered in the United States are Cumberland, Reg. No. 1 and Midland, Reg. No. 2. The former, previously designated Southern Disease Resistant Blend, is resistant to southern anthracnose [*Colletotrichum trifolii*] and crown rot [cf. above, p. 3]. The latter variety, formerly known as Central Corn Belt Blend, is fairly resistant to northern anthracnose [*Kabatiella caulivora*] and winter-hardy.

Hey (A.). **Anbautechnische Massnahmen als Pflanzenschutzmittel im Feldanbau der kleeartigen Pflanzen.** [Cultural-technical practices as plant-protectives in the field cultivation of plants of the Clover family.]—*Forschungsdienst*, xiv, 5–6, pp. 304–329, 1942.

In connexion with the serious shortage of seed of such protein-containing fodders as certain clovers, lucerne, sainfoin (*Onobrychis*) [*sativa*], and serradella (*Ornithopus*) [*sativus*] now prevailing in Germany, the writer gives a valuable survey of the literature dealing with various aspects of the cultivation of these crops, especially in relation to the control of their diseases and pests by modification of cultural practices.

Nicolaisen (W.), Leitzke (B.), & Witzig (I.). **Untersuchungen im Rahmen der Züchtung der Kleearten auf Widerstandsfähigkeit gegen den Kleekrebs (Sclerotinia trifoliorum Erikss.).** [Investigations within the framework of breeding Clover varieties for resistance to Clover stem rot (*Sclerotinia trifoliorum* Erikss.).]—*Phytopath. Z.*, xii, 6, pp. 585–645, 10 figs., 1940.

The following are the chief preliminary results of investigations at the Kiel (Schleswig-Holstein) Institute for Fodder Cultivation on stem rot (*Sclerotinia trifoliorum*) of clover, a disease of great and increasing economic importance [*R.A.M.*, xviii, p. 318 and next abstracts].

Ten seed samples of different species of clover of varying origin were examined for spores, mycelium, and sclerotia. Although only two red clover samples contained three spores resembling those of *S. trifoliorum*, it would appear from field observations that seed transmission does occur. The ascospores are forcibly discharged from the apothecia in 'clouds' 40 to 60 mm. in height, which may be dispersed by the wind and under outdoor conditions are liberated for as long as three weeks.

Observations on the germination of sclerotia from pure cultures on maltyl (barley malt) agar at 18° to 20° C. showed an after-ripening period of at least four weeks to be necessary. Apothecial production is stimulated by the weather normally prevailing in the field in September and October. Hereditary variations in the length of time essential for germination were shown by the sclerotia from different monospore cultures. None of the methods tested for the acceleration of sclerotial germination proved uniformly successful. There was no appreciable reduction of mycelial growth in culture between 10° and 20°, but darkness retarded both mycelial development and the formation of sclerotia in certain strains. Since modifications in environmental and nutritional conditions induce striking differences in the cultural characters of identical clones of *S. trifoliorum*, care must be taken to draw conclusions only on the basis of abundant material. Moreover, even when cultural uniformity is maintained, extensive variations occur in the rate of mycelial growth, the number and size of the sclerotia, and the configuration of the colonies, the collections frequently consisting of a mixture of single strains. Degeneration, expressed primarily by abnormalities of sclerotial formation, was observed in some of the collections.

Single spores of *S. trifoliorum* are easily isolated from the apothecia at 10°, and as the sclerotia arising from such spores produced normal apothecia and ascospores, the fungus is assumed to be monoecious. Mycelial anastomoses were not observed, and thus there is presumably no risk of the development of new physiologic races of the pathogen through heterothallism. Mycelium from monospore cultures was a satisfactory inoculum. Both uni- and binucleate ascospores were produced. Copious deposits of calcium oxalate crystal were a feature of the cultures.

Winter peas and summer and hairy vetch were susceptible to experimental infection with *S. trifoliorum* from red, white, and crimson clovers, while lucerne was also attacked by inoculum from the first two sources. Conversely, isolates of the fungus from peas and hairy vetch were pathogenic to the three abovementioned species of clover.

The fact that reputedly resistant red clover plants, after infection with one strain of the pathogen, collapsed and died when attacked by other isolates, is considered to point to the existence of physiologic specialization in *S. trifoliorum*, but further experiments are necessary to elucidate this problem.

FRANDSEN (K. J.). **Meddelelse om Kløverens Bægersvamp (Sclerotinia trifoliorum).** [A note on the Clover cup fungus (*Sclerotinia trifoliorum*).]—*Nord. Jordbr-Forskn.*, xxiv, 1–2, pp. 12–23, 1 fig., 1942.

Following a summary of recent important contributions to the knowledge of clover rot (*Sclerotinia trifoliorum*), a destructive pathogen of the crop in Denmark, the writer describes a preliminary experiment in 1941 to determine the mode of spread of the fungus through the soil. Sclerotia were used as the inoculum, a few grams of which were placed on the surface of the soil in seven flower pots (a different isolate in each) and introduced into the test plots at the end of August, the pots being let into the soil so that their surfaces were on a level with those of the plots. The plants used in the trial were five strains of red clover [*Trifolium pratense*], alsike [*T. hybridum*], white clover [*T. repens*], bird's foot trefoil [*Lotus corniculatus*], snail clover [*Medicago scutellata*], and lady's finger [*Anthyllis vulneraria*]. Early in October, the sclerotia in some of the pots began to produce apothecia, but during the latter part of September mycelial infection was already perceptible in various parts of the plots. One culture only gave mycelium, which severely attacked the plants within its range. As the season advanced, the outbreak assumed a virulent character, especially on the western side of the experimental area, which was protected from the prevailing wind by a hedge. Mycelium crept along the surface of the soil in the humid atmosphere between the plant rows, thereby contributing to the spread of the pathogen, which in some cases seemed to proceed from the dead stems and leaves on the ground to the living plants. It is clear from these observations that the mycelial dissemination of *S. trifoliorum*, without the intervention of apothecia or ascospores, may be of great importance in dense plantings.

The impracticability of combating clover rot by chemical treatment or crop rotation necessitates the development of resistant forms by breeding, and experiments along these lines have been in progress in Denmark for the past 10 to 15 years, but hitherto no really large-scale investigations have proved feasible. In 1940–1 the writer conducted an experiment in mass inoculation on the lines recommended by Nicolaisen *et al.* in Germany [see preceding abstract], involving the use of mycelium instead of ground sclerotia. At the age of eight days, the mycelium from a culture on clover leaf decoction plus dextrose is transferred to a glass cylinder, in which it is thoroughly shaken up with glass pellets so as to disintegrate the hyphae [cf. *R.A.M.*, xxii, p. 81]. In this way a relatively homogeneous mycelial emulsion is obtained, which can be directly applied to the plants by means of an atomizer. For this purpose the seedlings are grown enclosed in

wooden frames, which are transferred to greenhouse benches, covered with a layer of damp peat mould, when the plants reach the age of two or three months. After inoculation it is generally advisable to leave the frames *in situ* for another three or four weeks, by which time the disease should be sufficiently advanced to enable the reactions of the seedlings to be assessed.

It has frequently been claimed by Swedish, German, and Russian workers on the clover rot fungus that late-maturing varieties are more resistant than early ones, but the opposite has so far been the case in Denmark. In the mass-inoculation trial under discussion, for instance, out of 1,800 Øtofte early red clover plants 13·7 per cent. survived, and out of 2,225 medium-late only 6·8.

In an experiment with various isolates of *S. trifoliorum* from red clover, namely, EK-1, 2, 3, 14, and 18 (grouped together) from Øtofte Farm, Lyngby, K-5 from the vicinity of Randers, and K-38 from Svaløf (Sweden), K-5 was more virulent than the EK-isolates on the Øtofte early and medium-late red clovers, 24·6 per cent. of the 1,749 plants inoculated with the latter surviving compared with 10·1 per cent. of the 1,708 on which the former was used, while K-38 was the weakest of all, 23·7 per cent. of the 3,490 plants of miscellaneous lines inoculated with this isolate surviving as against 1·9 of the 3,526 to which the EK-strains were applied.

Studies have further been conducted at Øtofte on the life-history, and more especially the cytology, of *S. trifoliorum* [*R.A.M.*, xxii, p. 98]. In very young cultures anastomoses between the hyphae of different mycelia may be detected, presumably affording further opportunities for nuclear fusion and eventual hybridization between different genotypes. The development of new physiologic races in this manner, and the varying pathogenicity of the fungus in different localities, are likely to present difficulties in breeding for resistance [see preceding and next abstracts].

Nilsson-Leissner (G.). **Skriftligt diskussionsinlägg.** [A written contribution to the discussion.]—*Nord. JordbrForskn.*, xxiv, 1–2, pp. 24–32, 1942.

In this contribution the author observes that the work of breeding for resistance to clover rot (*Sclerotinia trifoliorum*) is to some extent complicated by the detection of physiologic races of the pathogen [see preceding abstracts], but the promising results already secured in mass-inoculation experiments, e.g., with Svalöfs Mercur, Øtofte medium-late, and Weibulls Resistant red clover [*Trifolium pratense*], show the position to be by no means hopeless. At the same time, the wide distribution of the more aggressive biotypes of the fungus must be taken into account. For instance, Mercur, which has shown a resistant reaction to the disease in central and southern Sweden, as well as in Germany [*R.A.M.*, xvii, p. 186], is highly susceptible in the north of Sweden and at Øtofte, Denmark. An experiment has now been in progress for nine years on heavily infested soil at Svalöf, in which the field was divided into two sections, one with English rye grass [*Lolium perenne*] and the other with a mixture of timothy [*Phleum pratense*] and red clover preceding the red clover crop. Mercur consistently gave higher yields than the other four varieties tested over an average of five years, especially on the plots succeeding the grass and clover mixture, and an early Polish line the lowest.

Ramsey (G. B.). **Fruit and vegetable diseases on the Chicago market in 1940 and 1941.**—*Plant Dis. Reptr*, xxvi, 21, pp. 442–452, 1942. [Mimeographed.]

Brief, popular notes are given on the incidence of disease in fruit and vegetables arriving at the Chicago market during 1940 and 1941.

Chandler (W. H.). **Deciduous orchards.**—438 pp., 104 figs., 4 diags., 1 graph, Philadelphia, Lea & Febiger, 1942.

Included in this treatise on the cultivation of deciduous orchard trees, with

special reference to Californian conditions, is much valuable information on nutrient deficiencies and storage disorders.

Notes contributed by the Biological Branch. Wood rot of fruit trees.—*Agric. Gaz. N.S.W.*, liv, 7, pp. 318–322, 10 figs., 1943.

In New South Wales the most common and serious wood rots of fruit trees are yellowish rot (*Polystictus versicolor*) [*R.A.M.*, xvii, p. 327] and heart rot (*Schizophyllum commune*) [ibid., xxi, p. 144]; other locally important rots are red wood rot (*P. cinnabarinus*) [ibid., xi, p. 275], die-back (*Valsa leucostoma*) [ibid., xxi, p. 46], and pink limb blight (*Corticium salmonicolor*) [ibid., xxi, pp. 126, 282].

P. versicolor enters the tree through any exposed surface and spreads along a limb, producing a reddish-brown discoloration and blistering of the bark surface and a yellow staining of the underlying wood. Cracking occurs at the junction of the affected and healthy parts. The bark and wood eventually die. Trees infected for some time may show large cankered areas. *S. commune* gives rise to a blackish ink-like stain on the bark and discolours the underlying wood. The bark may crack longitudinally, and in time cankered areas develop and entire limbs die. *P. cinnabarinus* produces a red stain. *V. leucostoma* attacks only those trees that are in a weakened condition, but is a serious cause of loss, as it kills entire limbs. Entry is effected through injuries, for example, spurs or laterals killed by frost or spray chemicals. The infected wood is brown, and the overlying bark is darker than the adjoining healthy bark. Gum may be produced between the diseased and healthy zones. The first sign of attack is generally leaf wilt on a lateral, the dead limb being left bare. *C. salmonicolor* causes a pink incrustation on the bark, which turns white and cracks.

Control consists in careful tree surgery and the maintenance of a high level of general health.

COOLEY (J. S.). **Armillaria root rot of fruit trees in the eastern United States.**—*Phytopathology*, xxxiii, 9, pp. 812–817, 1943.

In the course of surveys of numerous fruit-growing regions of the eastern and central United States, stone fruit trees infected by *Armillaria* [*mellea*] were occasionally detected. The fungus was isolated from peach roots in the sandhills of North Carolina, but no evidence was forthcoming to implicate it in the primary causation of the decline, which may have been associated with adverse environmental factors. Observations covering an eight-year consecutive period on a diseased peach in the coastal plain of Maryland revealed a slow advance of *A. mellea* in the tree itself, but no sign of spread to the surrounding trees. Mostly negative results were obtained from inoculations made at monthly intervals on young pome and stone fruit trees, though in a few instances small, rapidly healing lesions developed on cherry and peach roots [cf. *R.A.M.*, ix, p. 331]. The sparse incidence of the root rot in the eastern as compared with the western States of the American Union may be attributable to the xeric conditions of the west coast inducing host susceptibility [cf. ibid., ix, p. 349].

BRICHET (J.). **La chlorose des arbres fruitiers à feuilles caduques.** [Chlorosis of deciduous fruit trees.]—*Fruit & Primeurs*, xiii, 132, pp. 12–16, 1943.

This is a useful summary, based largely on American studies, of the several possible methods of combating lime-induced chlorosis of deciduous fruit, forest, and ornamental trees, e.g., by the introduction of iron into the soil or its direct application by injection into the trunk in the liquid or dry state. Tables are provided showing the appropriate quantities of iron sulphate or other ferrous compounds to be used on trees of varying diameter, the number and depth of the bore holes for the introduction of the chemical, and the radius round the tree to

be covered and depth of the trench for the accommodation of the curative element, according to the method employed.

Remedies of this type, however effective for the moment, cannot replace the long-term benefits conferred by a rational cultural technique, such as that proposed by T. Wallace in England [*R.A.M.*, ix, p. 43] and successfully adapted to Californian conditions, consisting in the use of cover crops of clover or lucerne, which are heavy consumers of lime and require an abundant supply of nitrogen, preferably in the form of ammonium sulphate.

McKay (R.). **Notes on Apple scab in 1942.**—*J. Dep. Agric. Éire*, xl, 1, pp. 129–133, 1943.

This final report on spraying tests against apple scab (*Venturia inaequalis*) at Glasnevin, Eire, since 1935 [*R.A.M.*, xxi, p. 458] gives the results of applications made in 1942 to the trees which had served as unsprayed controls in the earlier experiments. The treatment given was lime-sulphur (1 in 40) at pre-blossom, followed by three post-blossom applications at 1 in 80.

The data showed that on the control trees of Allington Pippin, Annie Elizabeth, Bramley's Seedling, Gascoyne's Scarlet, and King Edward VII sprayed for the first time in 1942, the percentage of clean fruit ranged from 58 to 87; this is regarded as satisfactory in view of the conditions prevailing. The difference, however, in the percentages of clean fruit between these trees and others regularly treated amounted in five pairs out of six to over 21 per cent. in favour of the trees regularly sprayed. Severe infection was 8 to 35 per cent. more prevalent on the previously unsprayed trees than on those regularly sprayed. The fact that better control was obtained on the susceptible but regularly sprayed Bismarck variety than on the other previously untreated varieties demonstrates the importance of regular spraying.

Racicot (H. N.). **The importance of prompt action for the control of fire-blight.**—*Rep. pomol. Soc. Quebec, 1941*, pp. 21–25, 1 fig., [? 1942].

After briefly reviewing the present state of knowledge concerning the conditions necessary for outbreaks of apple fireblight [*Erwinia amylovora*: *R.A.M.*, xx, p. 537; xxii, p. 10], the author states that overwintering or 'hold-over' cankers must be present, and must have exuded. Rain is also necessary, as it lowers the concentrations of the sugars in the nectar of the blossoms and raises the moisture content of the twigs and leaves, thus rendering them susceptible to infection. It also serves to wash off the exudate, which reaches the young shoots and some of the blossoms. If strong winds prevail at the same time, new infections will be even more numerous. Should weather favourable to the flight of pollinating insects ensue, infection may be spread from blossom to blossom. It is essential, however, that some blossoms shall have been inoculated by rain if pollinating insects are to spread the disease; also, if sufficient cankers are present in each tree, rain alone will induce a severe outbreak. If the cankers have not exuded by blossoming time, or if they have exuded, but no rain has fallen during flowering, then little or no blossom infection will occur. If exudation takes place only after blossoming, only twig blight can arise. Pollinating insects often inoculate blossoms situated high up on the tree, with the result that twigs become diseased, and hold-over cankers are formed from which exudate is washed down by rain to most parts of the tree. Such diseased twigs are easily overlooked.

Wilkinson (E. H.). **Dry eye rot of Apples caused by Botrytis cinerea Pers.**—*J. Pomol.*, xx, 3–4, pp. 84–88, 1 pl., 1943.

In further studies of the dry eye rot of apples caused by *Botrytis cinerea* [*R.A.M.*, xxi, p. 459], the pathogenicity of the fungus was confirmed by isolation and

inoculation experiments. Pure cultures of the fungus were obtained in each instance from spores collected during the second stage of the disease [loc. cit.] and from rotted tissue of the first and third stages. Of the 83 isolations made from rotted tissue of the second stage, 56 gave pure cultures and 24 remained sterile; most of the latter were made from affected apples late in the season or during the first month of storage, indicating that the fungus may be killed as a result of desiccation. In inoculation experiments carried out during 1941 and 1942 with Cox's Orange Pippin and Laxton's Superb apples still attached to the tree (and in a small laboratory test with four unspecified varieties), all three stages of the disease were reproduced, but mostly separately. However, when 83 apples with injured calyces were inoculated on the tree and kept moist by a tape seal, all fruits developed the first stage and later, when the seals were removed, 80 passed into the second stage, while the remaining three entered directly into the third stage, as did apples inoculated in the laboratory and kept under moist conditions. It is suggested that a change from high to low humidity plays an important part in the drying-out of the lesions and frequently prevents the disease from developing into a complete soft rot of the fruit. The 1942 results clearly showed that mechanical injury to calyces must occur before infection can develop.

ORTON (C. R.). **Report of the Director, West Virginia Agricultural Experiment Station, Morgantown, for the biennium 1940 to 1942.**—*Bull. W. Va agric. Exp. Sta.* 307, 56 pp., 12 figs., 1943.

On p. 36 of this report it is stated that investigations in West Virginia have definitely established the fact that apple measles [*R.A.M.*, xix, p. 603] is not due to any parasitic organism; it may, perhaps, be induced by lack of one or more essential elements in the soil, or by the presence of some toxin. Very extensive experiments demonstrated that the disease is not controlled by applications of boron to the soil. The boron content of affected trees was not lower than that of healthy ones.

ESBJERG (N.). **Versuche zur Konservierung von Äpfeln. VI. Versuche zur Fruchtaufbewahrung unter verschiedenen Lagerverhältnissen.** [Experiments in Apple storage. VI. Experiments in fruit preservation under various storage conditions.]—*Tidsskr. Planteavl*, xlvii, pp. 306–325, 1942. [Abs. in *Chem. Zbl.*, cxiv (i), 21, p. 2251, 1943.]

The author describes the physiological processes accompanying apple storage and the various methods of retarding them by coating the fruit with oil, wax, or similar substances, or wrapping in oiled paper. In investigations carried out in collaboration with A. Jørgensen and E. Søndergaard at the Danish Plant Protection Station and an experimental farm from 1934 to 1942 'gernerfl.', a mixture of '*A*', shellac, castor oil, paraffin oil, and sandarac, gave good control of loss of weight and fungal infection, but increased the incidence of internal breakdown and affected different varieties inconsistently in respect of other storage diseases. Sunflower oil (2 per cent.) proved superior to paraffin, cod liver oil, or soy-bean for coating the apples, which also reacted favourably to wrapping in oiled paper. The results of disinfection tests with sterisol (chloramine) were inconclusive, while storage in diatomol reduced the severity of fungal attacks, but detracted from the appearance of the fruit.

WORMALD (H.). **Papery bark canker of fruit trees in relation to silver leaf disease.**—*J. Pomol.*, xx, 3–4, pp. 144–146, 1 pl., 1943.

Observations made at the East Malling Research Station showed that papery bark cankers on branches and stems of top-grafted fruit trees [*R.A.M.*, xix, p. 690] are often, but not invariably, accompanied by silver leaf (*Stereum purpu-*

reum). In 1935, a number of Newton Wonder apple trees that had been top-grafted with Laxton's Superb were found to be severely cankered. The wood in the regions of the cankers was discoloured, and isolations from it yielded pure cultures of *S. purpureum*. In the autumn of 1937, some of these trees bore fructifications of the fungus. Isolations made in 1936 from the wood of papery bark cankers on apple trees yielded *S. purpureum* in three cases and *Polystictus versicolor* in one. Inoculations in 1940 on young Lane's Prince Albert apple trees grown in pots with two isolates of *S. purpureum* from cankered apple, one from plum, and with the above-mentioned strain of *P. versicolor* produced silver-leaf symptoms only on branches inoculated with *S. purpureum* from apple, these also showing the greatest wood discoloration. The tree inoculated with *P. versicolor* showed little discoloration, only slightly more than the uninoculated controls. It is concluded that *S. purpureum* is not the cause of papery bark cankers, but that the same conditions favour both, namely, cutting back the main branches when the tissues contain an abundance of sap. It is, therefore, recommended for the control of both to adopt frame-working in place of top-working. With regard to *P. versicolor* it is established that the fungus is capable of entering grafted trees, but it remains uncertain whether it can act as a parasite.

Harrar (J. G.) & Menzies (J. D.). **Diseases of Pears in Washington.**—*Pop. Bull. Wash. agric. Exp. Sta.* 171, 31 pp., 6 figs., 1943.

The symptomatology, etiology, and control of a number of diseases affecting pears in Washington are described in semi-popular terms. Among them may be mentioned the spur and blossom blight caused by *Botrytis cinerea*, which appears to be confined, on the host in question, to a few localized areas in the Pacific Northwest, the susceptible varieties being Bartlett, Anjou, Cornice, Winter Nelis, and Bosc. Infection spreads from the blighted buds or wilted blossoms to the whole spur, which turns black. The mycelium may proceed to the branch from which the spur arises, but does not usually penetrate far along it. Cankers are often formed at the union of the spur and parent branch, and occasionally so-called 'false fruits' develop in the shape of fleshy swellings just above the cankers. Young fruits are seldom attacked, but in such cases they tend to drop by early summer. The inflorescences are infected by means of the spores copiously produced in early spring, the mycelium subsequently becoming established in diseased spurs and cankers, on which sclerotia are formed in the autumn, to give rise in their turn to the profusion of conidia initiating the new season's infection.

Manns (T. F.). **Peach yellows and little Peach.**—*Bull. Del. agric. Exp. Sta.* 236, 2 col. pl., 11 figs., 1 graph, 1942.

In studies carried out in Delaware evidence was obtained that the chief reservoirs locally of both peach yellows and little peach [*R.A.M.*, xx, p. 480] infection is the plum [ibid., xix, p. 388], which is also the chief host on which the vector *Macropsis trimaculata* breeds.

When bearing peach trees were budded simultaneously with buds affected with yellows and little peach, a complex of both was shown in the fruit; this is occasionally found in natural infections when both diseases are active. The period of time required for either condition to appear in peach after budding or grafting was ascertained to depend largely on where the bud or graft is placed, the speed with which union takes place, and the kind of material used. Certain plum varieties, such as Myrobolan (*Prunus cerasifera*) [or *P. divaricata*] and Pissardi (*P. c.* var. *pissardi*), are much more active in bringing about infection than is peach. Infection will appear in four to six weeks in July or August, if infected Myrobolan plum is used, if the buds are placed near the growing point, and if the growing points and lateral branches are cut back. If grafts are made on the roots,

it may take three or four years before the disease becomes apparent. If the buds are placed low on the plant, the time required may be two years.

There is much masking of both diseases in certain plum varieties [ibid., xvii, p. 223], some of which mask them completely, while the vector breeds on them in abundance. *P. cerasifera* (the foundation root-stock on which most cultivated plums are budded) and its var. *pissardi* are examples showing complete masking. Other plum varieties, e.g., Wickson, show symptoms more quickly than peach does, and may succumb the first winter after infection. The author believes that a properly isolated, State-controlled source for virus-free *P.* spp. would be a valuable means of supplying nurserymen with stock free from virus diseases. The yellows and little peach viruses cause continuous growth in the peach and the infected trees fail to become dormant for the winter, with the result that winter-killing is the chief factor causing death.

In an appendix, brief descriptions are given of the symptoms of the chief virus diseases affecting peach, mention being made of those parts of the United States in which each has so far been found.

Fresa (R.). **'Frosty mildew' del Duraznero en el delta del Paraná (Argentina).** ['Frosty mildew' of the Peach in the Paraná Delta (Argentina).]—*Rev. argent. Agron.*, x, 3, pp. 231–234, 1 pl., 1 fig., 1943.

The author records, for the first time in Argentina, the occurrence of *Cercosporella persica*, the cause of frosty mildew of peaches [*R.A.M.*, xvi, p. 759], near the delta of the river Paraná during the years 1937 to 1941. The conidia of the fungus, found on the white foliar spots measured 11 to 64 by 4 to 7 μ. The perfect stage, *Mycosphaerella persica* [loc. cit.] was not observed. Pycnidia and pycnospores, measuring 56 to 84 by 47 to 70 μ and 4·2 to 5·6 by 1 to 1·4 μ, respectively, were found on the necrotic lesions which usually followed upon the white spots, and were also formed in culture, the pycnidia then being 42 to 200 by 42 to 120 μ. Inoculation experiments carried out during 1942 indicated that the fungus is only parasitic when the average maximum temperature is under 25° C.

Wallace (T.) & Jones (J. O.). **The control of manganese deficiency in fruit trees.**—*Rep. agric. hort. Res. Sta. Bristol, 1942*, pp. 18–23, 1 diag., [1943].

Experiments on the control of chlorosis of fruit trees due to manganese deficiency [*R.A.M.*, xx, p. 438] were carried out in 1942 at two centres in the Bristol Province. Satisfactory results were obtained by injecting solid manganese sulphate into stems of apple and plum trees, or by spraying apple trees with manganese sulphate at petal-fall stage and later. Application of manganese sulphate and sulphur as fertilizers was without effect, although sulphur treatment controlled manganese deficiency in Globe beet growing between the trees on the fertilizer plots. Injections of iron or spraying with iron or copper gave no benefit. It is concluded that a commercial control of manganese deficiency in apple trees can be readily achieved by the addition of manganese sulphate at a rate of 3 lb. per 100 gals. to the usual petal-fall lime-sulphur spray. Spraying at a later stage is likely to give poorer results.

Duggan (J. B.). **A promising attempt to cure chlorosis, due to manganese deficiency, in a commercial Cherry orchard.**—*J. Pomol.*, xx, 3–4, pp. 69–79, 1 pl., 1943.

It was observed during a visit to a Kent orchard in 1937 that some 100 cherry trees were chlorotic and that some of these bore no fruit. The disorder first appeared as a yellowing of the leaf spreading from the margins inwards until only the midrib and the bases of the lateral veins remained green; later the interveinal areas gradually became brownish-purple in colour, most markedly so on

the under surfaces; and finally scorching developed from the margins inwards. The size of the leaves and new shoot growth were reduced and eventually first the spurs and then quite large branches died, but in no case was a whole tree killed. The variety Governor Wood was most severely affected, Amber Heart and Roundel Heart less so, and Early Rivers and Bigarreau Napoleon least. From spectrographic analysis of the soil it appeared that the affected trees were suffering from a serious manganese deficiency [see preceding abstract] and a slight lack of magnesium. Attempts to remedy the disorder by the application of farmyard manure failed. Spraying with solutions containing varying amounts of manganese sulphate brought some improvement (particularly manganese sulphate plus lime spray), but this was insufficient for practical purposes. Slightly better results were obtained with liquid injections of manganese sulphate solutions into large branches and whole trees, but the results indicated that injection in quantities sufficient to effect a lasting cure is not yet practicable. In tests carried out from 1939 to 1942, complete control lasting for three growing seasons was obtained by injecting manganese sulphate in solid form into large branches and whole trees. The perfected procedure was to insert tablets of dry manganese sulphate (each less than $\frac{1}{2}$ in. in diameter, $\frac{1}{4}$ in. long, and weighing 1 gm.) into holes spaced round the trunk at intervals, one hole for each 1 in. of the diameter of the trunk, at any convenient height, closing the holes with thin corks. All of the 80 mature trees thus treated in 1942 bore dark green leaves and produced new shoot growth from 4 to 8 in. long, where previously less than 1 in. growth had been made during several years, and nearly all the trees carried a moderate crop.

WORMALD (H.). **Field observations on the Cylindrocladium shoot wilt of Plum and Cherry layers.**—*J. Pomol.*, xx, 3–4, pp. 80–83, 1 pl., 1943.

Further details are given on the wilting of plum and cherry layers, observed at the East Malling Research Station in 1932 [*R.A.M.*, xvi, p. 756]. During 1935 and 1936, the disease was responsible for the death of 22 to 62 per cent. of the shoots of plum varieties, and 21 to 49 per cent. of those of cherry grown in an experimental plot; during 1941, about 40 per cent. of the shoots of Brompton and over 50 per cent. of St. Julien A plums were killed in the commercial layer beds. In the same year a similar fungus was isolated from wilted shoots of a cherry root-stock received from Wisley, Surrey.

The disease was shown to be directly correlated with earthing-up operations, no wilting developing in layer rows of common Mussel plum left uncovered during the summer, while in earthed-up rows from 60 to 130 shoots in a row, out of a total of about 2,000, were wilted. The wilting is usually most noticeable during July and early August, and less conspicuous earlier (it first appears in mid-June) or later. It is usually preceded by a yellowing of the foliage, except in the Mahaleb cherry, where the leaves turn a creamy white. The wilting tends to affect lower leaves first, but eventually all flag and wither completely. The lesions, from 2·5 to 9·5 cm. long, usually completely girdle the shoot. Occasionally, however, healthy-looking shoots were found to be only half-girdled, and callus forming at the edges of lesions indicated that further spread of infection had been arrested. On shoots with flagging leaves the lesions are dark brown, but on dead ones they are mostly silvery-grey with microsclerotia showing up clearly when examined with a lens. Microsclerotia were also readily formed in culture, while fructifications of the fungus were observed only in nature, the branched conidiospores each bearing a cluster of cylindrical, colourless, bicellular conidia, about 50 by 5 μ. On many conidiophores the central axis is prolonged beyond the cluster of spores and terminates in a sterile knob. Pending more detailed studies the parasite is tentatively considered to be a cultural variety of *Cylindrocladium scoparium*.

From field observations it is assumed that the parasite is a soil organism and

that the infection is spread through soil. Growers are, therefore, advised against transplanting material for layering from infected plots to new sites; where it must be done, however, the roots should be thoroughly washed in clean, preferably running water to free them from soil which may be infested. The effectiveness of fungicidal treatment has not yet been tested.

MONTGOMERY (H. B. S.), MOORE (M. H.), & HOBLYN (T. N.). **A field trial of measures designed for the control of bacterial canker of Victoria Plum trees.**—*Rep. E. Malling Res. Sta., 1942*, pp. 53–61, 1943.

A full account is given of experiments carried out at East Malling since 1932 on the control of plum bacterial canker (*Pseudomonas mors-prunorum*) [see above p. 2], (*a*) by building resistant frameworks upon which to work the susceptible Victoria variety and pruning at a safe time of the year, and (*b*) by spraying. The use of the resistant varieties, Myrobolan B [*Prunus divaricata*], Warwickshire Drooper, Utility, and President to form the stem and crotch of trees on which to graft Victoria successfully prevented the development of stem cankers. Differences were noted in the vigour and cropping of Victoria with different varieties as stems, all on Myrobolan B rootstock, and in the case of Victoria on President stems on Myrobolan B rootstock, the combination was incompatible. Trees pruned in summer showed as many cankers as those pruned in autumn. Spraying the stems and crotch with Bordeaux mixture (10–15–100) in October during the first four years following planting did not successfully control the condition, but spraying the foliage with Bordeaux mixture (4–6–100), particularly three weeks after petal-fall and later, gave appreciable control of the shot-hole stage of infection, and reduced the number of branch cankers, though it did not appreciably reduce the number of stem cankers.

The most salient result of the work was the success that followed the use of a resistant variety upon which to graft Victoria. Whether this resistance will prove permanent is, however, uncertain. President is evidently unsuitable for the purpose, at any rate upon Myrobolan B, because of the apparent incompatibility. From a commercial point of view, Myrobolan B offers the best possibilities, as the stem can be grown on its own roots, and the trees are therefore cheap to produce.

The following tentative recommendations are made. Resistant varieties, such as Myrobolan B or Warwickshire Drooper, should be used to make a framework for valuable susceptible ones. Spraying should be carried out with Bordeaux mixture (4–6–100) about three weeks after petal-fall, and with a colloidal copper preparation diluted to contain approximately 0·025 per cent. metallic copper about three weeks later.

WORMALD (H.). **Bacterial diseases of acid Cherry trees.**—*Rep. E. Malling Res. Sta., 1942*, pp. 61–62, 1943.

The most usual symptom of bacterial attack on acid cherries is leaf spot. When numerous spots are present, they are very small and angular, but when the spots are few, they are larger, less angular, sometimes almost circular, and up to $\frac{1}{8}$ in. in diameter. They are dark brown, and the larger ones are generally surrounded by a pale green or yellow halo. If the spots are moderately numerous, the leaves may curl up at the edges, or the leaf-blades may become distorted. Severe leaf-spotting is generally accompanied by bacterial blossom blight, the flower trusses turning almost black and withering. When the flowers are killed, the disease may spread to the twigs, in which case all the leaves and flowers above the invasion site wither up, with the result that twig blight occurs. Further infection may appear as the fruit develops. Portions of the fruit stalks turn brown or black, and fruit development is checked. Dark, sunken spots may appear at the side

or lower end of the fruits. The most serious form of infection occurs when the branches or stems are attacked, because in that case the main limbs and even whole trees are affected, and if girdled, die within a year.

These diseases occur on Morello cherries, but bacterial leaf spots have been observed on the Flemish Red and Kentish Red varieties, and leaf spots and blossom blight on Carnation cherries.

The symptoms described do not necessarily occur together, or in one season. Leaf-spotting occurs almost every year on Morello at East Malling, blossom blight has been observed occasionally, fruit infection was found in two seasons, and fruit stalk lesions were seen only in 1939.

Culture plates from the lesions gave rise to one or other of two kinds of bacterial colonies, referred to as forms A and B. Both were isolated from flower spurs, leaves, fruit stalks, and fruit, while A was also obtained from branches, and on one occasion from a stem. Organism A is regarded as being probably identical with *Pseudomonas mors-prunorum*. On nutrient agar with cane sugar, B colonies have a different structure from those of A [*R.A.M.*, xv, p. 703; xvi, p. 756]. Both were found by inoculation tests to be pathogenic. Each, when sprayed on to Morello foliage, caused leaf spot, and readily infected green Morello fruits when inoculated through punctures; Morello branches were killed by inoculation with A.

PALMITER (D. H.) & HAMILTON (J. M.). **Organic materials in pre-harvest sprays for Cherries.**—*Phytopathology*, xxxiii, 8, pp. 683–690, 2 figs., 1943.

Since 1938 the writers have been seeking a substitute for sulphur in the control of cherry brown rot (*Sclerotinia fructicola*) and grey mould (*Botrytis cinerea*) in New York State. Some of the data obtained in orchard trials with fermate (ferric dimethyldithiocarbamate) have already been published [*R.A.M.*, xxii, p. 261], and in the further tests herein described both this preparation and the Jap beetle spray (tetramethyl thiuramdisulphide) were more effective than spergon or micronized sulphur against the two diseases when applied as pre-harvest sprays at 1 in 100 to the Tartarian, Windsor, Schmidt, Giant, and Black Republican sweet varieties. The concentration may be reduced to ½ in 100 if more than one treatment is made or the operations are carried out during the harvest. Used as a pre-harvest spray, fermate was shown by moist-chamber studies and market observations to be superior to the other fungicides tested in prolonging the keeping quality of the cherries: a self-emulsifying cottonseed oil spreader (½ pint) should be added to lessen the amount of visible residue left on the fruit and to obviate cracking.

Sprayed on to glass slides coated with cellulose nitrate, fermate and Jap beetle proved equally toxic to the conidia of *S. fructicola*, and two to three times more so than micronized sulphur or red copper oxide. Fermate and red copper oxide were experimentally shown to be more adherent than sulphur or Jap beetle, the retentiveness of which was enhanced, however, by the admixture of self-emulsifying cottonseed oil.

KEITT (G. W.) & MOORE (J. D.). **Some results from experiments on Cherry leaf spot control in 1942.**—*Wis. Horticulture*, xxxiii, 7, p. 175, 1943.

Cherry leaf spot [*Coccomyces hiemalis*] occurred in an exceptionally severe form in Wisconsin in 1942 [*R.A.M.*, xxi, p. 442] and for the first time fruit infection, especially on the Early Richmond variety, constituted a problem even in well-sprayed orchards. The dissemination of the ascospores was presumably favoured by a series of heavy and protracted rains shortly preceding the second spray (a fortnight after petal-fall), the normally effective Bordeaux residues on the treated foliage being inadequate to prevent the invasion of the fruit under these extreme conditions. In experiments in Door County on Montmorency trees, three

applications of 6–8–100 Bordeaux mixture gave fairly satisfactory control of both foliar and fruit infection, while almost equally good results were obtained with four applications at half strength. Four treatments with Tennessee copper 34 plus lime, 3–3–100, with the addition of orthex, 1–800, gave somewhat inferior protection to that conferred by Bordeaux, the latter being approximately equalled, however, by fermate (ferric dimethyldithiocarbamate) $1\frac{1}{2}$–100, plus lime at the same dosage, for all pre-harvest applications. In the three-spray Bordeaux schedule high-magnesium lime was somewhat more toxic to the fungus than the high-calcium formula.

CONDIT (I. J.) & HORNE (W. T.). **Mosaic spots of Fig fruits.**—*Phytopathology*, xxxiii, 8, pp. 719–723, 2 figs., 1943.

During the past few years 58 out of 4,034 caprifig seedlings at the California Citrus Experiment Station were found to be suffering from mosaic [*R.A.M.*, xx, p. 542], manifested by the presence on the body or neck (the latter being particularly susceptible) of typically circular, crateriform, brownish, necrotic, centrally depressed protrusions, 1 to 6 mm. in diameter, sometimes zonate, with an outer circle up to 10 mm. in diameter. This somewhat unusual type of mosaic, which appears to be narrowly restricted as to its host, closely resembles that observed some 20 years ago on the Samson caprifig variety (*Bull. Calif. agric. Exp. Sta.* 319, pp. 341–377, 1922). On edible figs the mosaic spots may assume various forms, e.g., concentric rings, dark, circular spots, or well-defined, pale green, circular areas. Negative results were given by experiments in the transmission of the mosaic virus from fig leaves to tomato and *Nicotiana glauca* plants.

DRUMMOND (O. A.). **Seca dos galhos da Figueira.** [Canker of Fig branches.]—*Ceres, Minas Gerais*, iii, 15, pp. 162–164, 3 figs., 1941. [English summary.]

In August, 1941, specimens of fig branches severely attacked by canker due to *Phomopsis cinerescens* [*R.A.M.*, xvii, p. 611] were submitted to the author from Caldas, Sul de Minas, Brazil, this being, according to H. H. Whetzel, the first record of the disease from the American Continent. Affected branches may be recognized by the dead bark and wood, covered with numerous dark, slightly raised dots, the pycnidia of the fungus, which are, however, liable to confusion at the first glance with the lenticels and natural rugosities of the healthy cortex. The dry, necrotic, elongated, fairly deep cankers may extend over entire transverse sections of the branch. Diseased trees should be drastically pruned and the wounds treated with Bordeaux paste, while fortnightly applications of Bordeaux mixture are also recommended to prevent the establishment of fresh infections by means of the conidia disseminated before the pruning.

Proprietary products for the control of plant pests and diseases. Scheme for official approval.—*J. Minist. Agric.*, 1, 7, pp. 331–334, 1 fig., 1943.

Further details are given of the scheme for official approval of proprietary fungicides and insecticides by the Ministry of Agriculture [*R.A.M.*, xxii, p. 71]. Products guaranteed by their makers to conform to an agreed official specification accepted by the Joint Panel (including lime-sulphur and tar-oil washes) will normally be approved without further evidence of their efficiency being required. On the other hand, products for which no official specification is as yet available, but of which the chief active ingredients are declared, will be approved only after sufficient evidence of their value has been supplied, e.g., of spraying or dusting properties, as indicated by rate of sedimentation or particle size, of stability in storage. Products, the composition of which the maker wishes to keep secret from the public, are not eligible for approval under the scheme.

Approved products will bear an official mark.

McCallan (S. E. A.) & Wellman (R. H.). **Cumulative error terms for comparing fungicides by established laboratory and greenhouse methods.**—*Contr. Boyce Thompson Inst.*, xiii, 3, pp. 135–141, 1943.

The authors suggest the fungicide × replicate test interaction as a suitable error term for laboratory and greenhouse methods of testing fungicides [*R.A.M.*, xx, p. 544], and give established error terms for certain specified methods together with the necessary differences for a given number of tests.

McCallan (S. E. A.) & Wellman (R. H.). **A greenhouse method of evaluating fungicides by means of Tomato foliage diseases.**—*Contr. Boyce Thompson Inst.*, xiii, 3, pp. 93–134, 4 figs., 9 graphs, 1943.

The authors describe a greenhouse method of testing foliage fungicides, for which tomato (variety Bonny Best) was chosen as an ideal host, and *Alternaria solani*, *Phytophthora infestans*, and, to a lesser degree, *Septoria lycopersici* as suitable parasites. The fungicide was applied with an adjustable paint spray gun to three 6-in. plants placed under a hood on a compound turntable (revolving disk carrying three smaller independently revolving disks). The variables involved were standardized in such a manner that at a 40 lb. constant air pressure for the gun, $2\frac{1}{2}$ fluid valve turns, and 30 seconds' spraying time the plants received 0·75 c.c. of spray per 100 sq. cm. leaf surface. After spraying and drying the plants were subjected to an artificial rain of tap water and then inoculated with a known concentration of spore suspension. This was applied by means of a hand atomizer at 20 lb. pressure for 30 seconds, so that an average of 17 spores was deposited per 1 sq. cm. of leaf surface, using a spore suspension concentration of 10,000 spores per 1 c.c. The plants were then placed for 24 hours in an incubation chamber with a constant relative humidity of 100 per cent., and then returned to the greenhouse. Lesions of *A. solani* and *P. infestans* developed within two or three days, while those of *S. lycopersici* appeared after ten. As lesions of *P. infestans* tend to coalesce, they must be counted before this occurs. The total number of lesions on three leaves was counted. On 6-in. plants the greatest number of lesions usually appeared on the fifth, sixth, and seventh leaf. Per unit area, young plants and leaves were more susceptible than older ones; the relation between number of lesions and leaf position was linear. The number of lesions developing was directly proportional to the number of spores, or motile swarm spores in the case of *P. infestans*, present: the maximum number of the motile swarm spores occurred after about six hours at 10° C.; spores of *A. solani* showed maximum infectivity from three to six days after scraping the cultures; while spores of *S. lycopersici* infected readily from cultures up to four weeks old. Approximately 200 lesions per three leaves may be expected to result from inoculating with 5,000 spores per c.c. of *P. infestans*, 25,000 of *A. solani*, and 200,000 of *S. lycopersici*. The approximate percentages of infection by the spores of the three fungi are, respectively, 6·5, 1·7, and 0·2. The standard deviations for lesions on replicate check plants expressed as a ratio are: 1·25, 1·34, and 1·98 for the three fungi, respectively, the last one differing significantly.

The fungicides studied were Bordeaux mixture, yellow cuprocide, Tennessee copper '34', lime-sulphur, mike sulphur, flotation sulphur, wettable spergon, fermate, and thiosan, all tested three times against *A. solani* and *P. infestans* in dosages of 0·0016, 0·008, 0·04, 0·2, 1·0, and 5·0 per cent. concentration. The lesion counts were expressed as percentages of the control and the results plotted on logarithmic probability paper. For an analysis of variance the LD_{95} (95 per cent. disease control) was demonstrated to be a more precise point to compare fungicides than is LD_{50}, as at the LD_{95} level variance between replicate tests and replicate plants is significantly smaller and for fungicides it is greater, in the case of both diseases, than at the LD_{50} level. All fungicides excepting Bordeaux, which was

convex upward, plotted as straight lines, generally much flatter than for laboratory tests. For both diseases the curves of spergon, lime-sulphur, and flotation sulphur were relatively steep, for fermate and thiosan intermediate, and for the three copper fungicides and mike sulphur very flat. In a laboratory test with Tennessee copper '34' and thiosan against *A. solani*, thiosan gave the steeper dosage-response curves and rated as the better fungicide, as it also did in the greenhouse test.

In conclusion it is recommended that preliminary tests be made with a 0·2 per cent. concentration of spray on one plant, and repeated a second time, while more precise tests should include several dosages at one plant each, repeated several times with a determination of the LD_{95}.

WELLMAN (R. H.) & MCCALLAN (S. E. A.). **Correlations within and between laboratory slide-germination, greenhouse Tomato foliage disease, and Wheat smut methods of testing fungicides.**—*Contr. Boyce Thompson Inst.*, xiii, 3, pp. 143–169, 11 graphs, 1943.

In order to study the correlations between laboratory and greenhouse methods of testing fungicides, LD_{50} values were determined for 599 compounds by the laboratory slide-germination technique [*R.A.M.*, xxii, p. 145], using *Sclerotinia fructicola*, *Glomerella cingulata*, *Alternaria solani*, and *Macrosporium* [*Stemphylium*] *sarciniforme*; the foliage disease method [see preceding abstract] was applied for ascertaining disease percentages in Bonny Best tomatoes following sprays with 0·2 per cent. concentrations of 56 compounds against *A. solani*, *Phytophthora infestans*, and *Septoria lycopersici*; and finally the percentage of smut (*Tilletia tritici* [*T. caries*] race 10) on artificially infected Hindi wheat (*Triticum aestivum*) following treatments with 0·5 per cent., by seed weight, of 126 compounds was determined. Three replicate determinations were also made for 30 compounds by the slide-germination technique and for 56 compounds by the tomato foliage disease method.

The laboratory fungistatic tests proved more nearly reproducible and more precise than the tomato foliage disease tests. The majority of the compounds examined, the nitrogen, nitrogen plus sulphur or oxygen where tautomerization was impossible, chlorine, and copper compounds, gave as close correlation between slide-germination and tomato foliage disease tests as could be expected in correlating the means of the same number of diseases in the greenhouse. Some of the uranium and chromium compounds were more effective in the laboratory than in the greenhouse, and some of the nitrogen plus sulphur or oxygen compounds, in which tautomerization could exist, were markedly more effective in controlling tomato foliage diseases than would have been anticipated from the results of slide-germination tests, the same marked differences in rating by the two methods persisting, even when the same fungus was used in both tests. Wheat smut results were more highly correlated with tomato foliage disease results than with slide-germination results, particularly in the case of compounds that gave poor correlation between slide-germination and tomato foliage disease results.

In conclusion, it is suggested that in tests with dissimilar compounds, those having LD_{50} values below 100 p.p.m. in the initial slide-germination tests should be given greenhouse disease tests before a selection of compounds is made for field experimentation; and that nitrogen tautomers should be subjected to greenhouse tests regardless of their slide-germination ratings. The slide-germination method, as the more precise, should be used in work with similar compounds or with several lots of the same chemical.

WELLMAN (R. H.) & MCCALLAN (S. E. A.). **A system for classifying effectiveness of fungicides in exploratory tests.**—*Contr. Boyce Thompson Inst.*, xiii, 3, pp. 171–176, 1 graph, 1943.

A system is described by which fungicides are classified, for purposes of pre-

liminary tests, according to their effectiveness as A, B, C, D, and E, a special class, AA, embracing compounds that give exceptional performance by any of the different testing methods. The methods employed for evaluating the fungicides are: (1) slide-germination test [see preceding abstract] with *Sclerotinia fructicola*, *Glomerella cingulata*, *Alternaria solani*, and *Macrosporium* [*Stemphylium*] *sarciniforme* as test fungi; (2) tomato foliage disease test [loc. cit.] with *A. solani*, *Phytophthora infestans*, and *Septoria lycopersici* on Bonny Best tomatoes; (3) counts of dusted, smutted (*Tilletia tritici*) [*T. caries*] Hindi wheat (*Triticum aestivum*) [loc. cit.]; and (4) greenhouse phytotoxicity test determined by applying single doses or a series of doses of a chemical to bean, buckwheat, and tobacco. For all four methods the results are expressed in a twofold way: for (1) as either test tube dilution LD_{50} in p.p.m. or as settling tower LD_{50} in micrograms deposit per sq. cm.; for (2) as either per cent. disease at 0·2 per cent. spray or as LD_{95} in per cent. spray; for (3) as either per cent. disease at 0·5 per cent. chemical or as LD_{95} in per cent. chemical; and for (4) as either injury at 1 per cent. spray or as threshold of injury as per cent. of spray. The class limits for the four methods are presented in a table. It is intended that, as other methods are developed, similar classes shall be made for the results obtained.

YARWOOD (C. E.). **Bordeaux injury to foliage at low temperatures.**—*Plant Physiol.*, xviii, 3, pp. 508–516, 1 fig., 1 graph, 1943.

Following the observation made in California in 1941 that potatoes sprayed with Bordeaux mixture against late blight (*Phytophthora infestans*) appeared to sustain greater injury from frost than did unsprayed plants, the relation of Bordeaux injury [*R.A.M.*, xxi, p. 207] to low temperature was investigated during 1942 under controlled conditions in the greenhouse. The results showed that Bordeaux sprays increase the transpiration of beans over a temperature range from 0° to 37° C., and decrease the leaf temperatures of beans and potatoes (by as much as 3·6° in one test). Exposure to 0° for 12 hours resulted in injury to sprayed bean, potato, cucumber, and cantaloupe foliage. Both sprayed and unsprayed cantaloupe plants showed injury at 0° to 2°, but the sprayed ones were the more severely damaged; at 20° to 34° neither showed marked spray or temperature injury; and at 40° both showed temperature injury without spray injury. Cabbage plants suffered no injury of either kind at any temperature from 0° to 40°. Since wilting was an immediate symptom of Bordeaux injury at low temperatures it is concluded that the injury is directly associated with the water relations of the plant, and is probably a result of the increased water loss due to Bordeaux, combined with decreased absorption and translocation of water at low temperatures.

COLQUHOUN (T. T.) & STEPHEN (V. A.). **An air-conditioned experimental cabinet.**—*J. Aust. Inst. agric. Sci.*, ix, 2, pp. 77–80, 4 figs., 1943.

A description is given of an air-conditioned experimental cabinet installed in the Waite Agricultural Research Institute, Adelaide, in which the air is not subjected to wide temperature variations in localized areas, but to small variations over a large surface. This facilitates humidity control. Within the experimental chamber, the air is circulated by two fans, the motors of which are mounted externally, and is kept constantly moving by movable glass slabs in such a way as to overcome dead spots; at the same time the slabs reduce to a minimum the effect of wind velocity within the cabinet. Temperature control is obtained by regulation of the temperature of the brine circulated through the conditioning unit. At present, only high humidities are maintained, but provision has been made for installing apparatus to maintain low ones.

REED (H. S.). **The production of coacervates.**—*Phytopathology*, xxxiii, 8, pp. 739–740, 2 figs., 1943.

The methylal solution of Sudan III was found to be an extremely useful reagent for staining phenolic coacervates in plant cells [*R.A.M.*, xxii, p. 34], a few c.c. being added to the surface of a catechol solution in a buffer solution at P_H 5·35. After three hours microscopic examination revealed the presence in the solution of globular masses, each enveloped in a vesiculated layer of lecithin, which had assumed an orange-red colour. Similar but smaller coacervates were found in solutions of catechol buffered at P_H 6·35 and 7·35, often with radiating strands of lecithin. Coacervates were obtained with resorcinol dissolved in water, but not in a phosphate buffer solution, while alcohol was also a useful solvent for lecithin, a layer being placed on top of a solution of catechol plus neutral red in a phosphate buffer at P_H 5·35, into which it diffused slowly.

Seed Potato certification.—*J. Minist. Agric.*, l, 6, p. 285, 1943.

Under a new system of certification of seed potatoes which is to come into operation at once in England and Wales, Northern Ireland, and the Isle of Man, certificates for crops of stock seed standard will bear the letters 'SS', those for the highest grade commercial seed will carry the letter 'A', while the general certificates for commercial seed will be marked 'H'. Following these letters the country of origin will be indicated thus, '(E)' for England, '(W)' for Wales, '(Nor. Ir.)' for Northern Ireland, and '(I.O.M.)' for Isle of Man. Finally, 'N.I.' will be added in respect of varieties not immune from wart disease [*Synchytrium endobioticum*]. When seed from a certified crop is offered for sale for planting in England and Wales, the seller must quote the letters and numbers of the relative certificate. Certificates issued this year by the Departments of Agriculture for Scotland and Eire will bear the same designations as before.

MONTGOMERY (H. B. S.) & SHAW (H.). **Field trials of phenyl mercury chloride for the control of Potato blight.**—*Rep. E. Malling Res. Sta., 1943*, pp. 68–70, 1943.

In experiments carried out at East Malling in 1941 and 1942 concentrations of phenyl mercury chloride up to 0·0025 per cent. failed to give any appreciable control of blight (*Phytophthora infestans*) on British Queen potatoes. Unless the use of a substantially higher concentration of mercury becomes economically possible, there appears to be small likelihood that this type of mercury compound will be able to compete with copper preparations for the control of the disease.

THOMAS (H. R.). **A nonchromogenic sporulating variant of Alternaria solani.**—*Phytopathology*, xxxiii, 8, pp. 729–731, 1 fig., 1943.

A non-chromogenic saltant of *Alternaria solani* (S-16), producing copious amounts of conidia, in contrast to the normal isolates from tomatoes affected by early blight in Indiana, which secrete a yellowish to deep red pigment in potato dextrose agar and sporulate sparsely, arose from a monospore culture from a leaf collected in California in 1937. It has since proved very useful in laboratory, greenhouse, and field studies on the disease necessitating the availability of large numbers of conidia. None of the conidia from tomato debris collected in Indiana during the winter of 1937–8 gave rise to cultures of the S-16 type, which has been maintained to date, however, by mass transfers on potato dextrose agar; on this medium it has grown more rapidly and diffusely and is superficially darker coloured than the ordinary isolates. The mean dimensions of 25 conidia of S-16 (exclusive of the beak), from artificially infected tomatoes in the field were $72{\cdot}2\pm2$ by $17{\cdot}7\pm1{\cdot}9$ μ, compared with $83{\cdot}3\pm1$ by $17{\cdot}3\pm0{\cdot}3$, $80{\cdot}5\pm1{\cdot}8$ by $16{\cdot}8\pm0{\cdot}3$, and $94{\cdot}4\pm1{\cdot}4$ by $17\pm0{\cdot}3\ \mu$, respectively, for three samples of 100 from naturally diseased plants.

Out of three collections of normal conidia (100 in each) two comprised none with fork-beaks, while in the third 62 per cent. were of this type. Among 100 conidia of S-16 from culture, 61 per cent. were fork-beaked, whereas none of the 25 from the field showed the characteristic in question.

In comparative inoculation experiments with suspensions of S-16 and normal conidia no differences were observed in the stem lesions, leaf spots, stem-end rot of the fruit, and spotting of green tomatoes induced by the two forms of *A. solani.*

KNORR (L. C.). **Ring rot of Potatoes.**—*Ext. Bull. Cornell agric. Exp. Sta.* 620 (*War Emergency Bull.* 113), 4 pp., 3 figs., 1943.

Potato ring rot (*Corynebacterium sepedonicum*) [*R.A.M.*, xxii, pp. 220, 223] is so infectious that a cutting knife drawn through an affected tuber will communicate the disease to the next 24 healthy tubers. The surfaces of crates, bags, bins, &c., that have become smeared with the ooze from an affected potato may spread the disease four months after the original contact. Infection may increase from a trace in one season to 60 per cent. in the next. In one county alone the losses from ring rot in a single season were estimated at from 500 to 700 carloads.

The best way to control the disease is to dispose of the infected stock, disinfect all equipment that has contacted affected potatoes, and procure disease-free seed. If certified seed is unobtainable, spread can be minimized by using a continuously sterile cutting knife. Such a knife can be constructed to resemble a circular saw, only with the teeth ground down to a knife edge, which must revolve in a tank of boiling water fastened to the under side of the cutting bench. Alternatively, several ordinary knives may be kept in a disinfectant solution, and after every fifth tuber has been cut, or after every diseased one, the knife used is changed for a clean one.

The cut seed should be dipped immediately in a 1 in 500 mercuric chloride solution for five minutes, and planted as soon as possible afterwards. Mechanical planters, particularly the picker type, in which the pick acts as an inoculating needle, also spread the disease. If ring rot occurs in planting stock, whole seed should be planted.

No tuber from an infected lot should be used for seed the following year; a new, clean source of seed should be found. In addition, all equipment and storage spaces that have come into contact with diseased potatoes, even during the previous season, must be disinfected. Crates, barrels, and baskets should be dipped in copper sulphate solution (2 lb. per 10 gals. water), and planters, diggers, washers, and graders treated in the same way. Bags should be soaked in boiling water. Storage spaces should be cleaned, every tuber being removed, and the walls should then be washed or sprayed with the copper sulphate solution. Rotation is desirable.

This bulletin is illustrated by three figures which will assist in the identification of ring rot.

FOISTER (C. E.) & WILSON (A. R.). **Dry rot in seed Potatoes. A summary of some recent experiments.**—*J. Minist. Agric.*, l, 7, pp. 300–303, 1943.

Dry rot [*Fusarium coeruleum*: *R.A.M.*, xix, p. 614] is stated to cause each year a certain amount of loss in most early varieties of potatoes, such as May Queen, Ninetyfold, and Arran Pilot, but in some years losses are exceptionally high in certain stocks. Thus, in 1941 and 1943 very serious losses were experienced in England with Doon Star. In investigations carried out in 1941 at the Midland Agricultural College, it was shown that careful handling does not give sufficient control of dry rot, although lifting by fork instead of spinner, dressing by hand instead of machine, and transportation in crates instead of in bags reduced the percentage of tubers affected by dry rot from 58 to 31. It was demonstrated that the only satisfactory means of controlling dry rot was dipping seed potatoes in organo-mercury compounds immediately after lifting. Dipping twice or applying

greening in conjunction with dipping did not give any additional benefit. In no case did dipping reduce the amount of dry rot below 4 or 5 per cent. The problem of de-activation of dips, which was found to be so rapid, in the presence of very dirty tubers, as to render the dipping little or not at all effective, is stated to be under investigation. Tubers should be thoroughly dried after dipping, as failure to do so may result in large losses through soft rots. Although the poisonous nature of mercurial dips, the high cost of dipped potatoes, and various practical difficulties, are stated to hinder the wide adoption of dipping on farms in Scotland, yet it is believed that the practice will become more general for the most susceptible varieties until such time as a better method of control is developed.

Plant protection.—*Qd agric. J.*, lvii, 1, pp. 32–39, 5 figs., 1943.

A brief note is given by R. B. Morwood on potato seed treatment against scab (*Actinomyces scabies*) and other diseases by means of hot formalin and (cold) mercuric chloride, while F. W. Blackford contributes a short, popular account of the symptoms and control of whiptail of cauliflowers and cabbages [*R.A.M.*, xx, p. 507].

Kunkel (L. O.). **Potato witches'-broom transmission by Dodder and cure by heat.** —*Proc. Amer. phil. Soc.*, lxxxvi, 3, pp. 470–475, 4 figs., 1943.

Details are given of nine experiments in which the potato witches' broom virus [*R.A.M.*, vii, p. 663; xxi, p. 301] was transmitted to *Nicotiana glutinosa*, *N. rustica*, tomato, sugar beet, and the Madagascar periwinkle (*Vinca rosea*) by means of the dodder, *Cuscuta campestris* [cf. ibid., xx, p. 590]. In the case of *V. rosea*, exposures to a temperature of 36° C. for seven days or 42° for three cured the tops but not the roots, while complete recovery was effected by 13 days' treatment at 42° [cf. ibid., xxi, p. 340]. Potato tubers up to ¾ in. in diameter responded favourably to six days' exposure to 36°, while potato, tomato, and *V. rosea* plants were benefited, but not altogether cured, by greenhouse summer temperatures exceeding 97° F. for considerable periods of the daylight hours. Witches' broom is stated to be the first potato virus and the ninth plant virus to be cured by heat.

Brickley (W. D.). **Diseased conditions in Potatoes and Peas associated with potash deficiency in south County Kildare.**—*J. Dep. Agric. Éire*, xl, 1, pp. 149–161, 2 figs., 1943.

A brown discoloration of potato foliage caused by potassium deficiency was found to be widespread in south County Kildare from 1940 to 1942. The affected plants were retarded in growth and showed a wrinkling of the leaves. Interveinal yellowing of the older leaves set in, followed by browning or bronzing of the yellow areas on both surfaces. Marginal scorch ensued, and in badly affected crops these leaves gradually withered. A similar disease cycle occurred in younger leaves. In crops most severely affected the stalks lost their turgidity, turned black, and died. Yields became depressed in proportion to the severity of the attack. In all cases when inquiry was made it was ascertained that farmyard manure was used, supplemented occasionally by artificial fertilizers mainly or entirely phosphatic. The condition also occurred on lea, where the potash content was found to be very low. Kerr's Pink was much more susceptible than Arran Consul, and Redskin than Arran Banner or Gladstone. Early varieties were more susceptible than maincrop varieties in the same soil.

Control consists in using a chemical technique to find out the mineral status of a soil where the condition occurs and applying an adequate quantity of potassic fertilizer. A knowledge of the nitrogen and phosphate contents is also necessary, as a relative excess of these also induces potassium deficiency. Localized placements of potash gave better yields than any other method tested.

Experimental evidence also showed potassium deficiency to be the cause of an abnormal condition of field peas; growth was retarded, a chlorotic condition was present, and the leaves viewed from a distance appeared greyish. Later, the older leaves showed scorching at the tip and began to wither, while the younger leaves subsequently became similarly affected. Control is recommended on the same lines as for potatoes.

TOTTINGHAM (W. E.), NAGY (R.), ROSS (A. F.), MAREK (J. W.), & CLAGETT (C. O.). **A primary cause of darkening in boiled Potatoes as revealed by greenhouse cultures.**—*J. agric. Res.*, lxvii, 5, pp. 177–193, 3 figs., 1943.

Greenhouse studies carried out in Wisconsin from 1934 to 1939 to ascertain why potatoes sometimes darken after boiling [*R.A.M.*, xxi, p. 441] showed that blackening depended most directly on the record of the tubers planted. It was rare, and apparently independent of fertilizer additions, in crops from normal seed stock, but was almost invariably present in crops from discolouring seed stock. The abnormality was common in Rural New Yorker and Irish Cobbler but rare in Chippewa and Triumph.

Differences in the rates of supply of the major nutrient elements and of iron and boron did not affect the condition, which was also independent of the omission of manganese, copper, and zinc, other than as accidental constituents. Boron deficiencies which induced growth disturbances did not cause discoloration of the boiled tubers. Subjection of the developing tubers to heat, drought, and a combination of these factors, did not consistently produce discoloration of the cooked tubers. Spraing [ibid., xviii, p. 201] developed in tubers grown in sand with under 3 per cent. moisture, but was not always associated with blackening after boiling.

The stocks in which the condition occurred appeared to be free from the common potato diseases, but as the tendency to develop the discoloration is inherited, it is thought that an unrecognized virus or some other disease may be present.

Annual Report on the Department of Agriculture, Zanzibar Protectorate, 1942.—7 pp., 1943.

Several problems associated with 'sudden death' of cloves have been approached in the light of A. H. Campbell's conclusion as to the non-parasitic character of the disease [*R.A.M.*, xx, p. 342]. A mulching experiment, started in 1940, was discontinued during the period under review, when it became evident that the malady could not be arrested by this measure once a plantation was invaded. Negative results were likewise obtained in a small-scale trial involving the application of boric acid as a fertilizer for mature trees and saplings, leaf ash analyses having revealed a deficiency of boron in the affected cloves. Underplanting dead and dying old trees with young ones was found to be the most effective method of regeneration.

CONNERS (I. L.). **The rusts of Safflower.**—*Phytopathology*, xxxiii, 9, pp. 789–796, 1943.

In connexion with the discovery of *Puccinia carthami* on safflower (*Carthamus tinctorius*) in Saskatchewan and Manitoba in 1942, the writer discusses the history, geographical distribution, and taxonomy of the rust, which is believed to have also occurred in Alberta and Ottawa in 1939 and 1940, respectively, judging by the presence of teleutospores on seed samples (of Hungarian origin) from these localities. *P. kentrophylli* Syd. is considered to be a synonym of *P. carthami*, whereas *P. carduncelli* is maintained as a distinct species, which also occurs in *C. calvus* and *Carduncellus caeruleus*.

Two other rusts, namely, *P. verruca* Thüm., and *Aecidium carthami* Dietr., have been reported on safflower. In connexion with the last-named the type host has

been found by K. Eichvald to be a species of *Centaurea* and not *Carthamus tinctorius*. Attention is drawn to an error on the part of Oudemans (*Enumeratio systematica fungorum*, iv, p. 1058, 1923) in listing *A. carthami* as a synonym of *P. carthami*. The same mistake was made in an abstract of Rodighin's paper on safflower diseases in the Volga region in this *Review* [xix, p. 116].

RICH (H.). **Die-back of Safflower in Texas.**—*Plant Dis. Reptr*, xxvi, 12–13, p. 282, 1942. [Mimeographed.]

During 1942 *Carthamus tinctorius* plants in an experimental plot in Texas developed a die-back which ruined 80 per cent. of the crop. The season was a very wet one, with high precipitation and humidity persisting as the young buds began to form, when the disease occurred. The plants died down from the tips and became dry and light brown, with the dead leaves remaining attached to the stem. The avenues of infection appeared to be the scaly bracts of the flowering parts and the stems at the point of attachment of the leaves. In some cases the leaf base became infected, the fungus forming a light brown, elongated lesion which spread up and down the stem. This lesion was observed to girdle the stem, killing all parts of the plant above it. A fungus which was, apparently, a species of *Gloeosporium* was found fruiting abundantly on the stem lesions.

MIDDLETON (J. T.). **Phytophthora rot of Belladonna.**—*Bull. Torrey bot. Cl.*, lxx, 3, pp. 244–251, 3 figs., 1943.

A full account is given of the root, crown, stem, and leaf rot of *Atropa belladonna* caused by *Phytophthora parasitica* in California [*R.A.M.*, xxi, p. 222], this being apparently the first detailed report of the disease in the United States. In addition to information already presented, the minimum, optimum, and maximum temperatures for the growth of the pathogen on maize meal and plain water agar cultures are stated to be 10°, 30° to 32·5°, and 37·5° C., respectively, these relationships and the morphological characters of the fungus agreeing with Tucker's observations on *P. parasitica* [ibid., x, p. 754].

Pythium ultimum is the principal agent of damping-off of *A. belladonna*, followed by *P. de Baryanum* and *P. irregulare*, while *Phytophthora parasitica* is also occasionally responsible for this form of injury, which may be combated by sowing in sterile soil in sterilized containers.

THIRUMALACHAR (M. J.). **A new rust disease of Cardamoms.**—*Curr. Sci.*, xii, 8, pp. 231–232, 3 figs., 1943.

Cardamom (*Elettaria cardamomum*) leaves in the plantations round Balehonnur, Mysore, and elsewhere in the same State were observed in 1940 to be attacked by an apparently new rust, designated *Uredo elettariae* n.sp. It is characterized by subepidermal, erumpent, pulverulent, white, aparaphysate uredosori, producing on short pedicels ovate to elliptical, white, echinulate, binucleate spores, 26 to 32·5 by 19 to 27·4 μ, which reinfect the same host, causing secondary symptoms. The first sign of the disease is a minute, yellow spot, which gradually dries up and spreads into a blotch simulating sun scorch. The mycelium continues to perennate along the margin, and under favourable conditions to give rise to fresh sori. The only other rust known on *Elettaria* is *Schroeteriaster elettariae*, recorded by Raciborski from Java in 1900, which differs from the specimen under discussion in its orange-yellow uredospores, measuring 24 to 30 by 15 to 20 μ.

BELL (A. F.). **Downy mildew, Queensland's most important Sugar Cane disease.**—*Proc. Qd Soc. Sug. Cane Technol., 1940*, pp. 155–160, [? 1940].

After discussing the reasons for the increased importance assumed by sugar-cane downy mildew [*Sclerospora sacchari*: *R.A.M.*, xxi, p. 503; xxii, p. 276] in

Queensland during the past ten years, and describing how infection is spread, the author states that diseased maize is a much more dangerous menace to adjacent healthy sugar-cane than is affected sugar-cane itself. The varieties approved for planting in the chief Mackay areas are Badila, Clark's Seedling, E.K. 28, Oramboo, Korpi, 1900 Seedling, Co. 290, P.O.J. 2725, D1135, S.J.2, Q20, and Q813, while P.O.J. 2714 and P.O.J. 2878 are allowed in the unaffected northern section where grubs are a serious pest. Of these varieties, Clark's Seedling, Badila, Q20, Q813, Oramboo, Korpi, E.K.28, 1900 Seedling, and P.O.J. 2725 are moderately to highly resistant, and should give little trouble unless grown next to heavily infected cane. D1135 is probably rather more susceptible, and Co. 290 considerably so. P.O.J. 2714 and 2878 are much too susceptible to be grown under present conditions.

The control methods recommended are as follows. Healthy planting material should be selected, and no plant should under any circumstances be taken from within a quarter of a mile of even a single diseased stool. The young plant and ratoon cane should be carefully inspected early in the season (before December if possible), and all diseased stools dug out. Affected fields should be burnt over before harvesting. Maize should not be grown in the vicinity of affected or susceptible sugar-cane.

Forbes (I. L.) & Mills (P. J.). **Disappearance of virus from mosaic diseased Sugarcane plants.**—*Phytopathology*, xxxiii, 8, pp. 713–718, 1943.

From 1940 to 1942 experiments were carried out in Louisiana to determine the position as regards the presence or absence of the mosaic virus in C[anal] P[oint] 29/320, 28/19, and 33/243 sugar-cane plants from which the pathological symptoms had disappeared [*R.A.M.*, xi, p. 265]. Healthy plants were inoculated with juices from mosaic plants, symptomless plants raised from diseased seed pieces, and plants apparently recovering during the current season. In all the 17 series of tests, involving 790 inoculations, the development of mosaic symptoms followed infection with diseased cane juices, the incidence of attack ranging from 10 to 80 per cent., whereas in 16 out of 17 negative results were obtained with the juices from symptomless and recovered plants: the appearance of mosaic in one out of 15 plants in the one positive trial is attributed to secondary field infection. These data are interpreted as indicating the absence of the virus from the two latter classes of plants. Experiments made in 1942, however, established the liability of apparently healthy plants grown from diseased seed pieces to reinfection by the mosaic virus.

Ellis (E. A.). **Miscellaneous observations. Plants.**—*Trans. Norfolk Norw. Nat. Soc.*, xv, 4, pp. 371–372, 1942.

The following items are included among a number of recent observations on the occurrence of Uredinales in Norfolk. The teleuto stage of *Puccinia maydis* was detected at Wheatfen in 1941 on maize grown from seed saved from the same garden in the previous year, this being apparently the first published record of the rust in Britain, though Professor W. Brown informed the writer that it was present about 1925 for two consecutive years on plants in the Chelsea Physic Garden. *Uromyces scillarum* has persisted on a colony of cultivated bluebells (*Scilla campanulata*) in Norwich Castle Gardens for 20 years.

Kern (F. D.) & Thurston (H. W.). **Additions to the Uredinales of Venezuela—II.**—*Mycologia*, xxxv, 4, pp. 434–445, 1943.

These new additions to the annotated list of Venezuelan Uredinales [*R.A.M.*, xviii, p. 141] comprise 33 species, bringing the total up to 238. They include *Phakopsora vignae* on *Phaseolus lunatus*, *Scopella sapotae* on *Achras sapota*, *Uromyces caryophyllinus* on carnation, and *U. flectens* on clover.

Cummins (G. B.). **Uredinales from the Northwest Himalaya.**—*Mycologia*, xxxv, 4, pp. 446–458, 7 figs., 1943.

This annotated list of rusts collected by R. R. Stewart alone or together with I. D. Stewart in the northern part of the United Provinces and in the Punjab, Kashmir, and the North-West Frontier Province of India contains the following interesting records. *Aecidium hederae* Wakefield was found on ivy (*Hedera helix*); the identification is based on a comparison made with type material, and it is pointed out that this name antedates the same name published by Arthur and Cummins in 1933 (*Mycologia*, xxv, p. 398). *A. montanum* is recorded on *Berberis ceratophylla*, *B. petiolaris*, and *B. zabeliana*. *Gymnosporangium clavariaeforme* is a new record for India, infecting both leaves and fruits of *Cotoneaster integerrima* and *C. nummularia*. Although Tranzschel records only *G. fusisporum* on these two hosts, the Indian collections do not show the ridged peridial cells described for that fungus but rather the verrucose ones typical of *G. clavariaeforme*. Another new record for India is *G. confusum* on *Crataegus oxyacantha*, *Pyrus lanata*, and *Juniperus macropoda*. Some uncertainty exists as to the telial collection of this species, for although the galls, teleuto scars, and teleutospores agree fairly well with *G. confusum*, the host on which it was found, *J. macropoda*, grew next to the *C. nummularia* from which *G. clavariaeforme* was collected, and such close association is considered to be highly suggestive, though not conclusive. *Melampsora larici-epitea* on *Salix hastata* and *S. oxycarpa*, and *Puccinia ribesii-caricis* on black currant are both new records for India. *P. coronata* was found on *Berchemia lineata*, *Rhamnus pentapomica*, and *R. virgata*; *P. graminis* on *Berberis asiatica* and *B. ceratophylla*; and *P. rubigo-vera* on species of *Aconitum*, *Actaea*, *Anemone*, *Aquilegia*, *Clematis*, and *Thalictrum* [cf. *R.A.M.*, xx, p. 293].

Banerjee (S.). **Importance of anatomical characters of the sporophores in the taxonomy-study of Thelephoraceae of Bengal.**—*J. Indian bot. Soc.*, xxi, 1–2, pp. 33–39, 21 figs., 1942.

This is a detailed comparative survey of the anatomical characters of the sporophores of the species of Thelephoraceae occurring in Bengal. The following features have received consideration in the characterization of the different hyphal systems involved in the construction of the fruit bodies: colour, width, wall thickness, septation, branching, contents, clamp- and H-connexions, and disposition in the sporophores. Observations are presented on the basidia, spores, cystidia, setae, gloeocystidia, paraphyses, hyphal pegs, and lactiferous or conducting cells, to all of which diagnostic significance is attached.

Shear (C. L.). **Mycological notes. VII.**—*Mycologia*, xxxv, 4, pp. 469–476, 1943.

Discussing the authorship of *Mycosphaerella grossulariae*, the perfect stage of the currant and gooseberry leaf spot fungus, *Septoria ribis*, the author considers that the correct name should be *M. grossulariae* (Auers.) Lindau, and not *M. grossulariae* (Fries) Lindau as it is commonly cited in the United States. It is uncertain at present whether *M. ribis* (Fckl) Felt. is the same species or not. *Sphaeria melastoma* Fr. 1823 was called *Valsa melastoma* Fr. in 1849 and was renamed *Valsella melastoma* (Fr.) Fckl. No morphological characters of specific value have been found by the author to separate the various species of *Valsella*, and in agreement with Petrak he considers that the genus represents a polysporous condition of *Valsa* [sub-genus *Leucostoma*].

Holmes (F. O.). **A tendency to escape Tobacco-mosaic disease in derivatives from a hybrid Tomato.**—*Phytopathology*, xxxiii, 8, pp. 691–697, 1 diag., 1943.

Detailed evidence is adduced in support of the conclusion that a tendency to

escape infection by the tobacco mosaic virus, introduced by means of abrasion or pruning, in the Chilean tomato (*Lycopersicum chilense* Dun.) and in certain derivatives from its hybridization with the cultivated species, is a heritable character. It remains to be seen whether this property can be transferred to, and incorporated in, commercial tomato varieties without interference with their abundant yields and other attractive qualities.

LIHNELL (D.). **Mosaiksjuka och Tabaksvaror.** [Mosaic disease and Tobacco samples.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vii, 3, pp. 8–12, 3 figs., 1943.

Successful transmission of the tobacco mosaic virus was effected by the application to tobacco and tomato plants of extracts from 7 out of 11 commercial samples (two cigars, three cigarettes, one pipe tobacco, and one snuff), showing the need for extreme care in the avoidance of this source of infection [*R.A.M.*, xvii, p. 560].

OFFERMANN (A. M.). **Determinación del 'Nicotiana virus 1' en Tabacos manufacturados y productos insecticidas.** [Determination of *Nicotiana* virus 1 in manufactured Tobaccos and insecticidal products.]—*Rev. argent. Agron.*, x, 3, pp. 268–274, 2 pl., 1943.

An examination of samples of 56 commercial brands of tobacco, cigars, and cigarettes showed that 37 of them carried *Nicotiana* virus 1 [tobacco mosaic virus: see preceding abstract]. The virus was not found in any of the eight insecticides containing nicotine which were also examined.

LAUFFER (M. A.) & STANLEY (W. M.). **The denaturation of Tobacco mosaic by urea. I. Biochemical aspects.**—*Arch. Biochem., N.Y.*, ii, 3, pp. 413–424, 1943.

This is an expanded, tabulated account of the writers' studies on the behaviour of the tobacco mosaic virus in neutral 6*M* solutions of urea, a preliminary note on which has already appeared [*R.A.M.*, xviii, p. 630]. The number of measurable sulphydryl groups was found to increase during denaturation by urea, which was further demonstrated to result in a loss of virus infectivity even before extensive disintegration of the nucleoprotein molecule. No method of reversing the over-all denaturation process could be devised.

BENNETT (C. W.). **Influence of contact period on the passage of viruses from scion to stock in Turkish Tobacco.**—*Phytopathology*, xxxiii, 9, pp. 818–822, 1943.

Experiments were carried out at the Sugar Plant Field Laboratory, Riverside, California, to determine the requisite periods for the passage from infected scions to healthy stocks of Turkish tobacco of the sugar beet curly top, [tobacco] ring spot, and cucumber mosaic viruses, severally and in combination. No curly top infection developed in plants in which the period of union was less than five days, but symptoms of the other two viruses began to develop with a two-day contact and increased rapidly as the period of contact increased. The ring spot virus appears to move more rapidly than that of cucumber mosaic from scions carrying all three viruses. Of the plants in the triple virus combination series, 23 showed infection by only one virus, 19 contracting ring spot and four cucumber mosaic symptoms only, while of 123 infected by only one virus, 102 suffered from ring spot and 21 from cucumber mosaic. Curly top symptoms failed to appear in grafts in which this virus was associated with one or both the other viruses.

The results show that the curly top, ring spot, and cucumber mosaic viruses can be separated from each other by taking advantage of the contact period required for passage of the respective viruses. The relative slowness of the passage of curly top from diseased to healthy tissues is tentatively attributed to its inability, in contrast to the other two test viruses, to migrate by way of the plasmodesmata

through certain types of parenchyma, resulting in its retention in the scion until phloem differentiation is initiated in the graft union [cf. *R.A.M.*, xvi, p. 650].

ANDERSON (P. J.). **Tobacco diseases in 1942.**—*Bull. Conn. agric. Exp. Sta.* 469, pp. 106–128, 9 figs., 1943. [Abs. in *Exp. Sta. Rec.*, lxxxix, 4, p. 457, 1943.]

Experiments on the control of tobacco downy mildew [*Peronospora tabacina*] in Connecticut in 1942 gave further promise of success with fermate [ferric dimethyl dithiocarbamate: *R.A.M.*, xxi, p. 506]. Better methods of para-dichlorobenzene [ibid., xxi, p. 505] application were developed, involving its distribution on cheese-cloth supported under the glass sash above the plates, a method that proved highly effective even at low temperatures.

Evidence was obtained of the hitherto unrecognized importance of *Botrytis* [? *cinerea*: ibid., xvi, p. 21] and *Sclerotinia sclerotiorum* [ibid., xii, p. 729] in tobacco pathology. The disease complex associated with these two fungi is manifested in the field by a leaf spot and rot and stalk canker, in the seed-bed by rot or damping-off, and in the shed by stalk and pole rot. Control may be effected in the seed-bed by improved ventilation and reduction of humidity, supplemented by spraying with Bordeaux mixture, while pole rot can be combated by the proper firing and airing of the sheds, but no practicable remedy against foliar rot and stalk canker has yet been devised.

SELMAN (I. W.). **The influence of lime and potash on mosaic infection in the Tomato (var. Potentate) under glass.**—*J. Pomol.*, xx, 3–4, pp. 89–106, 2 pl., 2 diags., 4 graphs, 1943.

In further experiments on the growth of glasshouse tomatoes (variety Potentate) inoculated with tomato [tobacco] mosaic virus [*R.A.M.*, xxii, p. 9], the interaction of infection with two levels of lime- and three of potash-manuring was investigated during 1941 and 1942. The plants were grown in 10 in. pots in steam-sterilized clay loam containing reserves of both lime and potash; five fruit trusses were allowed to develop, and inoculation was carried out when the first truss was in bloom. The appearance of symptoms was delayed where growth was retarded by lime and potash applications. Severe yellow-green foliar mottle was confined to the most vigorous plants grown without additional lime. Despite precautions control plants developed mosaic symptoms seven weeks after the introduction of the virus into the glasshouse, and when examined four weeks later significantly greater numbers of virus-free plants were present where sulphate of potash had not been applied than where it had been; additional liming had no such effect, although it tended to reduce vegetative growth and fruit yield.

A statistical examination of data recorded for each of the five trusses separately showed that the total number of flower buds per plant was not affected by mosaic, but reduced by applications of lime or potash; that the total number of fruits was reduced by mosaic and by liming, but unaffected by potash; that the average fruit weight was reduced by an increased potash level and slightly reduced by mosaic and liming; and that the total weight of fruit was reduced by mosaic, liming, and sulphate of potash. On individual trusses all these values were related to the position of the truss, the maximum total number of fruits being produced on the first and the least on the fifth truss. The highest total yield of fruit was 7 lb. per plant, from uninoculated controls receiving neither additional lime nor potash; of this total, 4 lb. 8½ oz. were ripe, unblemished fruit. The yield of mosaic-infected plants receiving no manurial treatment was 5 lb. 6 oz. (2 lb. 10½ oz.) per plant. Inoculated plants produced a greater number of 'chats' than did the controls, probably owing to virus-induced changes in the water relations of plants. Mosaic infection increased the percentage of fruits showing severe blotchy ripening, which was even more increased by the omission of potash. High potash-manuring

tended to reduce the incidence of blotchy ripening in inoculated plants but to increase it in the controls. Total flower and fruit production was found to be affected similarly by mosaic infection at all levels of lime and potash; significant interactions existed, however, between truss position, potash level, and mosaic infection for flower bud and fruit numbers. It is concluded that at certain stages of development there are differences in the potash requirement of both healthy and infected plants. It appeared that with the variety Potentate potash-manuring should be carefully controlled to insure immunity from accidental infection. When bulky organic manures are not used, lighter potash dressings are likely to increase the total yield of fruit of both healthy and mosaic-infected plants, but may produce fruit of inferior quality.

GRIEVE (B. J.). **Studies in the physiology of host-parasite relations. 4. Some effects of Tomato spotted wilt on growth.**—*Aust. J. exp. Biol.*, xxi, 2, pp. 89–101, 3 figs., 4 graphs, 1943.

The bronzing of Marglobe tomato foliage induced by the tomato spotted wilt virus was experimentally shown at Melbourne University to be associated with a significant reduction of dry weight, height, leaf area, leaf development, and water content of diseased plants in comparison with the healthy controls. The mottling sometimes observed in pot-bound plants or those growing under otherwise adverse conditions caused a less serious loss of weight and did not affect growth in height. The data secured in these tests indicate that, at any rate in part, the virus exerts its effects on dry weight through the partial disorganization and reduction in efficiency of the assimilative tissue, and on height by the destruction of the growth hormone. No correlation could be detected between the growth rate of the seedlings and the incubation period of the virus. The development of mottling in place of bronzing symptoms appears to be connected with changes in the growth rate, host metabolism, and relative virus activity.

MOORE (W. D.), THOMAS (H. R.), & VAUGHAN (E. K.). **Tomato seed treatments in relation to control of Alternaria solani.**—*Phytopathology*, xxxiii, 9, pp. 797–805, 1943.

In five years' experiments in southern Georgia, supplemented by some tests in Indiana and New Jersey, on the control of *Alternaria solani* on tomato [*R.A.M.*, xxi, p. 432] by means of seed treatments, both liquid and dry preparations tended to retard germination during periods of high temperatures combined with a moderate or low rainfall. During the two cool, wet seasons of 1937 and 1941 the organic mercury treatments significantly improved the final incidence of germination, and in the former year mercuric chloride exerted a similar effect. New improved ceresan (1 in 1,200, five minutes' immersion) plus cuprocide dust was the only treatment in the four-year experimental period giving an appreciable reduction of infection by *A. solani*, and that only in 1939, when it decreased the number of leaf spots per plot sample from 40·4 to 22·4. It seems unlikely, therefore, that the preparations so far tested will prove effective against stem canker and leaf spot in the locality under observation.

WELLMAN (F. L.). **A technique to compare virulence of isolates of Alternaria solani on Tomato leaflets.**—*Phytopathology*, xxxiii, 8, pp. 698–706, 1 diag., 1943.

In order to demonstrate relatively slight distinctions in the pathogenic capacities of individual isolates of the tomato early blight fungus (*Alternaria solani*), it was necessary to use a more refined laboratory procedure than that of Andrus *et al.* [*R.A.M.*, xxii, p. 116], and the following technique was therefore devised. Leaflets attached to one-month-old Marglobe seedlings were selected for the tests, and 6 mm. disks from maize meal-cane sugar-agar cultures used as inoculum. The course of

infection in the 1,140 leaflets on 380 plants was studied under controlled conditions of incubation at a temperature of 25° to 27° C. and compared with field observations, the progressive symptoms on diseased leaflets being classified according to numerical grades, which served as virulence indices. Statistical comparisons of the data resulting from controlled inoculation experiments showed the reactions of the leaflets to be reasonably consistent from one test to the next, and hence it was possible to express the relative pathogenicity of the seven isolates included in the trials on a numerical basis.

WAIN (R. L.) & WILKINSON (E. H.). **A preliminary trial of new copper fungicides on outdoor Tomatoes.**—*Rep. agric. hort. Res. Sta. Bristol, 1942*, pp. 56–58, [1943].

This paper presents the results of a small-scale spraying trial for the control of blight (*Phytophthora infestans*) [*R.A.M.*, xxii, p. 45] on outdoor tomatoes. The compounds tested were copper sebacate [ibid., xxii, p. 191], cupric cuprimalate A and B, and Bordeaux mixture, 4 : 4 : 50 and 4 : 4 : 100. As no blight appeared except on one fruit in a control block, no assessment could be made of the protective value of these substances. It was established that none of the new materials was injurious to tomato foliage or fruit. Copper sebacate gave a most conspicuous deposit, which, however, could be easily rubbed off the fruit. The cuprimalate deposits were not clearly visible after drying.

WILLIAMS (P. H.) & SHEARD (ENID). **Stem rot of Tomato caused by Phytophthora parasitica.**—*Gdnrs' Chron.*, Ser. 3, cxiv, pp. 96–97, 2 figs. (one on p. 95), 1943.

During the summer of 1943 a new type of stem rot of tomato caused by *Phytophthora parasitica* was observed on two occasions in Hertfordshire and one in Hampshire. The lesions were 1 to 4 ft. above soil-level. Some were found where leaves had been removed or where the stems had been bruised by the strings, but others appeared to have developed in the absence of mechanical injury. They were greyish-green, elongated, and up to 1 ft. in length. The stems became girdled only at an advanced stage of the disease. The cortex and pith had collapsed, and the outside of the stems was arranged in longitudinal folds.

The condition was reproduced by spraying the stems of healthy tomatoes with a suspension of the zoospores of the fungus, and the fungus was reisolated from the diseased plants. It is considered that the infection probably arose from tomato fruits affected with buck-eye rot. Control measures recommended include the destruction of all fruits affected with buck-eye rot. The plants should be kept trimmed and moist, and stagnant air conditions should be avoided.

LOHMAN (MARION L.) & WATSON (ALICE J.). **Identity and host relations of Nectria species associated with diseases of hardwoods in the United States.**—*Lloydia*, vi, 2, pp. 77–108, 1 fig., 1 graph, 1943.

The object of this paper is to present the morphological and cultural aspects of the species of *Nectria* designated by Spaulding *et al.* Nos. 1 and 2 [*R.A.M.*, xv, p. 542], and now identified as *N. coccinea* on the bark of *Acer saccharophorum* in New England; *N. coccinea* var. *faginata* n. var., isolated from the weak and mostly scale-infested cortex of beech (*Fagus grandifolia*) in New England and the Canadian Maritime Provinces; *N. galligena* from the bark, callus tissue, and recently exposed sapwood of various hosts, including *Acer* spp., birch (*Betula* spp.), beech, ash (*Fraxinus nigra*), *Carya* spp., walnut, poplar (*Populus grandidentata*), aspen, *Prunus serotina*, oak, lime (*Tilia americana*), and elm (*Ulmus americana*), throughout the eastern States, usually in association with cankers and on bud-scale scars; *N. magnoliae* n.sp. from the same portions, generally cankered, of *Liriodendron tulipifera*, *Magnolia fraseri*, and *M. tripetala*, from Connecticut to

Ohio and southwards through the Appalachian forests; and three somewhat aberrant forms of *N. mammoidea* from dead birch in Vermont and dead and living oaks in Maryland and Georgia, respectively.

The specimens of *N. galligena* comprised in these studies agree with the European descriptions of the species or its variety *major*, or with *N. ditissima* sensu Wollenweber and some of its varieties [ibid., vii, p. 677]. The saprophytic *N. coccinea* on sugar maple also corresponds closely with that species on beech in Europe and on *Magnolia* in the eastern States. The pathogenicity of *N. mammoidea* has not been investigated; the few previous records of this species in the eastern States are thought to rest on misidentifications of *N. galligena*.

Only a limited degree of reliability should be attached to any one morphological or cultural character for the diagnosis of *N.* spp., which should be based on ascospore shape and dimensions (mean of 25 free spores from a mixture of asci from several perithecia), micro- and macroconidial shape, and progressive colorations and mycelial habit on standard culture media (synthetic malt and potato dextrose agar and steamed rice). Both *N. galligena* and *N. c.* var. *faginata* were found to comprise pathogenic and non-pathogenic cultural strains, the potential virulence or otherwise of which could not be inferred from any one morphological or cultural character. *N. galligena* cannot be regarded strictly as a canker-producing fungus on Rosaceous hosts, nor was its var. *major* found to be confined to the genus *Fraxinus*. *N. c.* var. *faginata* has not been observed on species of *Acer*, *Betula*, *Carya*, *Juglans*, or *Quercus*, and it owes its recognition, not to reasons of geographical distribution or host specificity, but to its divergence from recent descriptions of European material of *N. coccinea* or its varieties.

An outline of the gross cultural characters on the three above-mentioned media of the species of *Nectria* under discussion is appended for use either in the provisional determination of cultures or specimens, or for the critical identification of the latter when considered in conjunction with the size and shape of ascospores and conidia. The bibliography comprises 40 titles.

GRODSINSKY (L.) & JENKINS (ANNA E.). **'Sphaceloma murrayae' en diversas especies de 'Salix'.** [*'Sphaceloma murrayae'* on various species of *'Salix'*.]—*Rev. argent. Agron.*, x, 1, pp. 55–58, 1 pl., 1 fig., 1943. [English summary.]

A comparative examination of material of species of *Salix* in several herbaria in the United States, besides a collection on *S. viminalis* from the Paraná Delta, Argentina, showed that *Sphaceloma murrayae* [*R.A.M.*, xxii, p. 411] occurs on *S. fragilis*, *S. fragilis*×*S. alba*, *S. lasiolepis* and its var. *sandbergii*, and *S. viminalis*, as well as on *S. babylonica*. The fungus, which causes a leaf spot, is named *Sphaceloma murrayae* n.sp., this description (based on Miss Murray's description of the fungus) being published on 15th March, 1943 [thus antedating that in *Trans. Brit. mycol. Soc.*, xxvi, pp. 1–3, 8th April, 1943].

LIHNELL (D.). **Tetramyxa rhizophaga Lihnell n. sp., ein Parasit in den Wurzeln von Juniperus communis L.** [*Tetramyxa rhizophaga* Lihnell n. sp., a parasite in the roots of *Juniperus communis L.*]—*Symb. bot. upsaliens.*, v, 4, 11 pp., 1 pl., 3 figs., 1942.

In two parts of Sweden the author detected a hitherto unknown representative of the Plasmodiophoraceae occurring as a parasite in juniper roots, and assigned to it the name of *Tetramyxa rhizophaga* n.sp., descriptive of the tetrahedral spore tetrads. The fungus, which is characterized by spheroid or broadly ellipsoid, continuous, subhyaline to light brown spores, 4 to 6 μ in diameter, differs from most of the other Plasmodiophoraceae in its failure to induce hypertrophy of the affected organs. The cytology of the new species is fully described.

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YOUNG (G. Y.). **Root rots in storage of deciduous nursery stock and their control.**—*Phytopathology*, xxxiii, 8, pp. 656–665, 1 graph, 1943.

Freezing, induced by lack of care in nursery practices, was found to be the primary cause of a root rot of stored stock of deciduous trees and shrubs which has been responsible for extensive damage in the Upper Mississippi Valley of recent years, among the species affected being black locust (*Robinia pseud-acacia*), Osage orange (*Maclura pomifera*), Russian mulberry (*Morus alba* f. *tatarica*), black walnut (*Juglans nigra*), wild plum (*Prunus americana*), bur oak (*Quercus macrocarpa*), and tulip tree (*Liriodendron tulipifera*). In the course of experiments in the autumn of 1938 in an Iowa nursery, in which a large number of species, besides those enumerated above, were subjected to a wide variety of in- and outdoor storage conditions, it was observed that plants injured through insufficient protection against frost were invaded by several kinds of fungi, *Fusarium* and *Alternaria* predominating. In wound inoculations, the former caused small local lesions on the roots of healthy specimens, but in no case did appreciable infection develop, and it is concluded that the particular form of deterioration in question may be reduced to a minimum by appropriate precautions, including the lifting and handling of stock at temperatures above freezing, deep heeling-in, preferably in loamy soils, for outdoor storage in northern nurseries, and the maintenance in sheds, root cellars, caves, and the like of a temperature ranging from 34° to 50° F. and a high relative humidity.

SHOPE (P. F.). **Some Ascomycetous foliage diseases of Colorado conifers.**—*Univ. Colo. Stud.*, Ser. D, ii, 1, pp. 31–43, 1943.

This paper gives information on 34 foliar diseases of Colorado conifers caused by Ascomycetes. Brown or black felt blight (*Neopeckia coulteri* and *Herpotrichia nigra*) [*R.A.M.*, ix, p. 75] is prevalent above 8,000 ft., affecting only seedlings and the lower branches of trees buried under snow during the winter and early spring. *N. coulteri* is found exclusively on pines, whereas *H. nigra* attacks other species also. Moreover, the ascospores of the former are normally bicellular and dark brown (*Phytopathology*, vi, pp. 357–359, 1916), while those of the latter are quadricellular and olivaceous. The mat-covered needles on blighted branches recently exposed by the melting snow are still green, but they eventually die and turn brown, while at the same time the originally black mat assumes a brownish tinge. The fungus often found growing on the mats of *H. nigra*, which is characterized by blackish, ovoid fructifications containing quinqueseptate ascospores, was identified by Seaver (*Mycologia*, vii, pp. 210–211, 1915) as *Mytilidion fusisporium*, Weir's determination of it (*J. agric. Res.*, vi, pp. 277–288, 1916) as a new species, *H. quinqueseptata*, being rejected.

In August, 1940, inconspicuous, dark brown apothecia, ½ to 1 mm. in diameter, with stellate apertures, were detected on the previous year's foliage of *Juniperus scopulorum*, at 8,000 ft. Two years later, the current season's needles were found to bear yellowish spots, less than 1 mm. in diameter, which may represent primary

infections. The relatively few ascocarps of the 1940 collection were occupied by asci containing four brown, smooth-walled, unequally bicellular spores, 15 to 17 by 11 to 13 μ. Material was submitted to G. D. Darker, who diagnosed the fungus as in all probability a new species of *Keithia*, or at least a new variety of *K. tetraspora*, the spores of which measure 21 to 24 by 13 to 16 μ (*Mycologia*, v, pp. 6–11, 1913). The author believes the juniper pathogen to be a new species, which he proposes to name *K. tetramicrospora*, a detailed diagnosis being withheld until further data and more fruit bodies are obtained. The disease affected only small trees (under 10 ft. in height) and the lower branches of larger ones, which would have been under snow during the winter.

Needle blight (*Rhabdocline pseudotsugae*) of Douglas fir [*Pseudotsuga taxifolia*] is of rare occurrence and little importance in the dry climate of Colorado.

Snow blight of *Abies lasiocarpa* is caused by *Phacidium balsameae* Davis, and the same disease of *Pinus flexilis* by *Phacidium planum* Davis, the latter species occurring solely in association with *Hypoderma saccatum*. Collections of these organisms were also made from the lower branches of trees growing at high altitudes, where the winter snow cover usually exceeds 15 ft. in depth. The ascospores mature in the late summer and are shed towards the close of the growing season.

Of the 41 North American species of needle-cast fungi listed by Darker [*R.A.M.*, xii, p. 254], 13 are known to be present in Colorado. These are enumerated with annotations and a key.

HAHN (G. G.) & AYERS (T. T.). **Role of Dasyscypha willkommii and related fungi in the production of canker and die-back of Larches.**—*J. For.*, xli, 7, pp. 483–495, 3 figs., 1943.

Wound-inoculation experiments conducted from 1930 to 1934 under controlled conditions in the field and in a greenhouse with cultures and apothecia of *Dasyscypha willkommii* demonstrated its capacity to infect injured tissues, cankers and die-back being induced on both vigorous and sickly larches of various species (*Larix laricina*, *L. leptolepis*, *L. decidua*, *L. occidentalis*, and *L. gmelini*). Apothecia were produced experimentally on the lesions only in a very few cases; the ascospores arising therefrom developed in malt agar cultures in the manner typical of *D. willkommii*, which was also readily reisolated from the mycelium commonly present in and on the canker tissues. The reisolates were not used for further tests in the United States, but T. R. Peace, of the Forestry Commission of Great Britain, carried out independent experiments at Oxford with the writers' material, which gave positive results on *L. decidua*.

In comparable field experiments by the authors with three related species, namely, *D. calycina*, *D. oblongospora*, and *D. occidentalis* [*R.A.M.*, xvii, p. 422], no growth was obtained either on healthy or sickly trees of *L. decidua*, *L. laricina*, or *L. leptolepis*. In contrast to *D. willkommii*, the saprophytes colonized the desiccated tissues distal to the girdling canker lesions.

The tests herein described, as well as those of Peace in England, have conclusively established the ability of *D. willkommii* to assume a pathogenic form without the concurrence of frost damage.

ROTH (L. F.) & RIKER (A. J.). **Life history and distribution of Pythium and Rhizoctonia in relation to damping-off of Red Pine seedlings.**—*J. agric. Res.*, lxvii, 4, pp. 129–148, 2 figs., 1943.

In a study of fungi causing damping-off of red pine (*Pinus resinosa*) seedlings [*R.A.M.*, xxii, p. 158] in Wisconsin, *Pythium irregulare* and *Rhizoctonia* [*Corticium*] *solani* were found to be the most destructive; *Fusarium* spp. were also isolated but proved, in inoculation tests, to be only slightly, or not at all pathogenic. The

symptoms induced by *P. irregulare* and *C. solani*, when operating alone (in soil inoculated with pure cultures), were distinct and appeared to be correlated with the growth habit of each. *P. irregulare* attacked the roots at any depth in the soil; attacks above the soil surface occurred only under very humid conditions, when growing over dead tissues. The point of infection appeared to be determined by the age of the tissues, the moisture content of the soil, and the location of the fungus. The attack by *C. solani* was mostly confined to the upper ½ in. of soil and to saturated air immediately above ground. Seedlings with elongating hypocotyls were subject throughout to attack by aerial mycelium of *C. solani*. After elongation had ceased, however, cotyledons and the primary shoot appeared to be the susceptible parts above ground. Minute mechanical injuries to the base of the hypocotyl greatly increased damping-off. The injury from clipping the cotyledons had no effect on susceptibility to *C. solani* but considerably increased that to *P. irregulare*. These results agreed with the nursery observation that bird injury also increases damping-off.

The life-history of the two fungi in relation to pathogenesis is relatively simple; both live in the soil and invade injured seedlings more easily than uninjured ones, they spread locally by growth through the soil, and at a distance by means of contaminated soil or other material, and they are capable of surviving for more than a year in sandy soil. *C. solani* survived well in soil containing only 10 per cent. of moisture and dry enough to blow as dust. Both fungi were commonly found in Wisconsin, but the predominance of the one over the other was influenced by weather, soil type and acidity, and ground cover. Little or no damping-off was associated with jack pine (*Pinus banksiana*) or jack oak (*Quercus ellipsoidalis*) cover on Plainfield sand. Discussion of the apparently strong influence of acidity, temperature, and moisture on the disease is reserved for later papers.

Andrews (S. R.) & Gill (L. S.). **Western red rot in immature Ponderosa Pine in the southwest.**—*J. For.*, xli, 7, pp. 565–573, 3 graphs, 1943.

During 1938–9 a survey was made in Arizona and New Mexico to determine the importance of western red rot (*Polyporus anceps* or *P. ellisianus*) in immature *Pinus ponderosa* stands [*R.A.M.*, xxi, p. 234]. Analysis of dead branches indicated that small ones (0·6 to 1 in. in basal diameter) were of relatively low susceptibility, while large ones (upwards of 1·1 in.) were liable to severe infection. In stands under 40 years old, the percentage of trees with at least one diseased branch was generally low; it was also erratic, and showed no correlation with any of the physical characters of the stands. In stands 41 to 100 years old, the incidence of infection was often high and closely correlated with all the measured characters except age. Analyses limited to this age group denoted that the effect of age increased directly with (1) the percentage of trees with one or more large dead branches, and (2) the percentage of trees exceeding 5 in. in diameter at breast-height. Infection was also found to increase as stand density decreased. Analyses of centre rot of branches dissected during the survey suggested a negligible incidence of decay below 40 years, with a rapid proportional increase above that age.

Wherever possible, a proposed crop tree should be examined for infection by western red rot: if a branch infected at the base is found, the tree is not worth further pruning and a substitute should be selected. Small-branched trees should be used as far as practicable, and the stands maintained in a high state of density for the first 80 years.

Walters (C. S.). **Treating fence posts with pentachlorphenol-fuel oil solutions.**—*J. For.*, xli, 4, pp. 265–268, 1943.

Very satisfactory results have been obtained in Illinois by the soaking of fence posts in a cold solution of 5 per cent. pentachlorophenol-fuel oil [cf. *R.A.M.*, xxii,

p. 47], the procedure being simple, economical, and particularly suitable for farm use. The posts can be treated either by full-length horizontal immersion in a stock tank or by standing them upright in 65-gal. steel oil drums and reversing the ends. An average-sized post (4·8 in. in top diameter, 1 cu. ft. in volume), absorbing $\frac{1}{2}$ gal. of the solution, can be produced for a total cost of about 40 cents, excluding that of the equipment. A period of 48 hours usually suffices for the complete treatment of white pine wood. As regards hardwoods, to judge by the absorption of solution and penetration of sapwood, *Catalpa* was the most difficult, and red and black oaks and hickory the easiest. The preservative is apt to cause dermatitis unless the workers' arms and hands are adequately protected, preferably with 'neoprene' rubber gloves.

WARNE (L. G. G.). **A case of club-root of Swedes due to a seed-borne infection.**—*Nature, Lond.*, clii, 3861, p. 509, 1943.

The author records three outbreaks of club root of swedes (*Plasmodiophora brassicae*) in a Manchester garden, in which the evidence pointed to a seed-borne infection. This is believed to be the first record of an outbreak of club root due to contaminated seed.

With the small amount of seed obtained from one of these diseased crops, sowings were made in boxes of sterilized compost of two varieties of swede, Best-of-All and Conqueror, and also of Brussels sprouts, Cambridge No. 5 variety, as controls; for each variety one box was sown with untreated seed and one with seed surface-sterilized with hypochlorite; and furthermore, two boxes of Brussels sprouts were immediately after sowing watered with swede seed washing obtained by soaking the seed in distilled water over-night. Examination of all the plants after harvesting showed that boxes sown with seed of both varieties of swedes developed considerable numbers of infected plants: 52·5 per cent. in Best-of-All and 15·6 per cent. in Conqueror swedes. Surface sterilization reduced these percentages to 41·3 and 1·6, respectively, indicating that the contamination of Best-of-All swedes is more adherent and consequently less easily removed by hypochlorite or water than is that of Conqueror. This is of importance in interpreting the other results obtained, namely that control plants watered with Best-of-All seed washings showed no infection, whereas those watered with Conqueror seed-washings developed 16·7 per cent. It is concluded that the disease is seed-transmissible, probably owing to surface contamination resulting from contact with infected soil.

OSMOND (D. A.). **A note on heart-rot in Sugar Beet in Herefordshire.**—*Rep. agric. hort. Res. Sta. Bristol, 1942*, pp. 46–48, [1943].

A survey made in 1942 in Herefordshire showed that heart rot of sugar beet due to boron deficiency [*R.A.M.*, xv, p. 626] was fairly widespread in that county, being present in 17 out of the 41 fields visited. Soil examination gave the following average values: centres free from disease had a calcium carbonate content of 0·14 per cent., P_H 6·32, and 8·09 p.p.m. of water-soluble boron; while the corresponding values for centres with severe symptoms were 1·67 per cent., P_H 7·17, and 4·91 p.p.m. It thus appears that heart rot is associated with a low water-soluble boron, and a relatively high calcium carbonate content of the soil coupled with P_H values of over 7. In pot experiments, heart rot was observed to occur under conditions favouring either drought or poor aeration. It is recommended that farmers intending to lime for sugar beet should have the soil tested beforehand. The application of heavy dressings of lime just before planting is not generally advised; where lime must be given, it is better to apply it at some point in the rotation other than immediately prior to the sugar beet crop.

CROXALL (H. E.) & OGILVIE (L.). **Experiments with protectant seed dressings, 1940–42.**—*Rep. agric. hort. Res. Sta. Bristol, 1942*, pp. 65–76, [1943].

Further greenhouse and field experiments with seed treatments against pre-emergence damping-off of peas [*R.A.M.*, xix, p. 640] showed that in garden soil, where the seed was exposed to infection, increased emergence could be obtained by treating the seed with either cuprous oxide (red or yellow), proprietary organo-mercury dressings, or spergon, at all dosages used (0·125, 0·25, and 0·5 per cent. of the weight of seed). When damping-off was severe the cuprous oxides were somewhat more effective than the organo-mercury dressings applied at the same rate, the yellow oxide being rather more effective than the red. There was no significant difference between the bright red and dark red cuprous oxides, nor was their efficiency impaired by the addition of graphite as a lubricant. The cuprous oxides, particularly the yellow, even when applied at the lowest rate, appeared more likely to cause injury to pea seed than the mercurial dressings, especially to the round seed variety Foremost in dry soil. It is, therefore, not recommended to use yellow cuprous oxide for pea seed treatment; while red oxide applied at a rate not higher than 0·25 per cent. can be used safely unless the soil is abnormally dry. Organo-mercury dressings are considered safe at the dosage recommended by the makers (0·25 per cent.). A reduced germination was caused by a mercurial dressing only in one test, when double the recommended dose was applied. In the few experiments with spergon promising results were obtained and it is considered to be worthy of further trials.

Isolation and inoculation experiments showed that *Pythium* spp. are mainly responsible for damping-off. *Rhizoctonia* [*Corticium*] *solani* was isolated in relatively few instances, but proved capable of causing decay of germinating pea seeds. This fungus was also observed by C. J. Hickman in the field in Worcestershire on peas which had failed to germinate. Onion, cabbage, savoy, and flax stands were not significantly increased by seed treatments, but emergence of tomato seed was improved by treatment with red cuprous oxide at 2 per cent. and yellow cuprous oxide at 0·25, 0·5, and 1 per cent. dosages, and with the proprietary organo-mercury M 1 at the 1 per cent. dosage. Seed treatment for tomato is regarded, however, only as a substitute for sowing in sterile soil.

WALKER (J. C.) & JOLIVETTE (J. P.). **Productivity of mosaic-resistant Refugee Beans.**—*Phytopathology*, xxxiii, 9, pp. 778–788, 3 graphs, 1943.

In a comparative investigation in Wisconsin, covering the period from 1937 to 1939 and resumed in 1942, on the yield, pod shape, rate of production, and canning quality of the mosaic-susceptible Stringless Green Refugee bean and five resistant varieties, four of the latter, viz., Idaho Refugee, U.S. No. 5 Refugee, Sensation Refugee 1066, and Sensation Refugee 1071, approximated closely to the improved Stringless Green Refugee (raised from mosaic-free seed) in cropping capacity and production rate. Sensation Refugee 1066 was consistently the earliest of all the varieties in pod formation at the canning stage, while Wisconsin Refugee matured later than the other four resistant sorts and usually failed to equal them in total yield. Pod shape and dimensions were practically uniform in the resistant varieties and the susceptible one, nor were there any differences between the comparative material in canning quality. In short, all the desirable characters of the original susceptible variety seem to have been retained in the resistant lines, but an attempt should be made to eliminate from Wisconsin Refugee and Idaho Refugee by further selection a variegation inherited from the resistant parent (Corbett Refugee), which is masked at high temperatures; it causes the production by affected plants of distorted pods unsuitable for processing [cf. *R.A.M.*, xix, p. 450].

Daines (R. H.). **Soft rot of Sweet Potatoes and its control.**—*Bull. N.J. agric. Exp. Sta.* 698, 14 pp., 2 figs., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxix, 4, p. 457, 1943.]

At least nine species of *Rhizopus*, with *R. nigricans* [*R. stolonifer*] predominating, are implicated in the etiology of soft rot, reported to be the most destructive post-harvest disease of sweet potatoes in New Jersey. The pathogen may develop through a temperature range of 38° to 107·6° F., its optimum lying between 65° and 73·4°, with an atmospheric humidity at the higher figure of 75 to 84 per cent. Preventive measures should include sanitation of storehouses and hampers, exclusion of rodents, avoidance of frost damage and sun scald, careful handling from harvest to storage, and maintenance of appropriate temperature and moisture conditions. For the 10- to 14-day curing period, a temperature of 80° to 85° and a relative humidity of 90 per cent. are recommended, followed by storage of the roots at 55° with a relative humidity of 85 to 90 per cent. The loss from soft rot on the market was significantly reduced by immersion of the roots in borax solutions after storage, but pending further knowledge as to the effects of the chemical on human health, this procedure cannot be generally advocated. A sodium hydrogen carbonate dip improved the appearance of the pale-coloured varieties.

Tucker (C. M.) & Routien (J. B.). **The mummy disease of the cultivated Mushroom.**—*Res. Bull. Mo. agric. Exp. Sta.* 358, 27 pp., 8 figs., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxix, 4, p. 459, 1943.]

Heavy losses have been caused in mushroom caves and houses in Missouri since 1935 by an obscure disease responsible for the development of abnormal sporophores, with elongated, slender stipes and small, tilted pilei: in advanced stages of infection most of the fruit bodies are arrested at the button stage, becoming grey or brown, dry, spongy, and mummified. The disease spreads through the bed at the rate of about 1 ft. daily, resulting in total failure of the affected areas. Transmission has been secured only by the transference of casing soil or compost from diseased to normal beds, the causal organism being present in these materials to a distance of 4 to 6 ft. in advance of the youngest visibly affected sporophores. The usual incubation period is about three weeks. Cultures of various micro-organisms from diseased sporophores failed to initiate infection. The infectivity of soil and compost from affected beds is rapidly destroyed by drying, moderate heating, or chemical treatment, which at the same time, however, would kill the mushroom mycelium. The rate of spread and difficulty of transmission suggest the causation of the disease by a virus transferable only by anastomoses between infected and normal hyphae. The progress of the pathogen was obstructed by the provision of narrow trenches across the beds 6 to 8 ft. beyond the visibly affected sporophores, and to a lesser extent by mercuric chloride barriers, while in commercial houses it has been reduced to unimportant proportions by the division of beds into short sections by double cross boards with a narrow air space between them.

Kassanis (B.). **Neutralization of some plant viruses by rabbit sera.**—*Brit. J. exp. Path.*, xxiv, 4, pp. 152–159, 1943.

The non-specific neutralization of the tobacco mosaic, tomato bushy stunt, and tobacco necrosis viruses by normal and heterologous sera was so extensive in the writer's experiments at Rothamsted that the additional specific effect of homologous anti-sera was relatively small [*R.A.M.*, xx, p. 316]. Specific neutralization was of use for the demonstration of serological relationships only in comparative tests on sera of the same age and similarly stored.

Unfrozen sera rapidly lost their non-specific neutralizing properties on storage. All heterologous anti-sera reduced the infectivity of the viruses to a greater degree than normal sera stored under comparable conditions.

Precipitating anti-bodies did not appear to be responsible for neutralization. No correlation was established between precipitin titre and neutralizing capacity, which was not affected, moreover, by the removal of precipitins. Only quantitative differences were observed in the behaviour of homo- and heterologous sera, the infectivity of all virus-serum mixtures being restored by dilution.

FULTON (R. W.). **The sensitivity of plant viruses to certain inactivators.**—*Phytopathology*, xxxiii, 8, pp. 674–682, 1943.

The sensitivity of tobacco mosaic, potato ring spot [potato virus X], cucumber mosaic, tobacco ring spot, and bean mosaic to inactivation by trypsin, milk, extract of *Phytolacca decandra*, bovine serum, and *Aspergillus niger* growth product was determined [cf. *R.A.M.*, xxi, p. 48]. Generally speaking, the sensitivity of the viruses to the inactivators increased in the order given above, but the specific responses of bean mosaic, tobacco ring spot, and cucumber mosaic to certain inactivators involved a reversal of these relationships. Although the extracts of tobacco mosaic and potato ring spot were much more concentrated than those of the other viruses, they did not require a much higher strength in the inactivators. The percentage of tobacco mosaic inactivated reached a maximum when the mixture with inactivator was most concentrated, and fell to a minimum at the greatest dilution. On the whole, the results supported the theory that the 'non-toxic' inactivators affect the virus and not the host.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 8, pp. 413–417, 6 figs.; 9, pp. 463–468, 6 figs., 1943.

The growing of lettuce varieties from California, including Imperial D, Imperial F, Imperial 847, and Imperial 615, is stated to have provided satisfactory control of downy mildew (*Bremia lactucae*) [*R.A.M.*, xx, p. 341] in Victoria prior to the appearance of a new strain of the fungus, which rendered all these varieties susceptible. Until new resistant varieties are produced, growers are advised to drench seedlings with 4–4–40 Bordeaux mixture during the first week of growth and again about four days prior to transplanting. This treatment will protect the plants in the seed-bed, but is unsatisfactory in the field.

Severe outbreaks of whiptail in cauliflower [ibid., xxiii, p. 39] can be controlled by the application of about 1½ to 2 tons of agricultural lime to the soil.

Mottle leaf of citrus due to zinc deficiency [ibid., xvii, p. 170] is particularly common in the northern irrigation districts of Victoria. The most satisfactory way of controlling the disease is by spraying the trees with a mixture of 3 lb. zinc sulphate and 1½ lb. hydrated lime with 100 gals. of water.

Psorosis of citrus [ibid., xiii, p. 300] is stated to be rare in Victoria, but there are a few affected trees in the Murray irrigation area. Growers are advised to be on the look-out for the disease and to eradicate the affected trees should such be found.

Blackleg of beet (*Phoma betae*) is becoming increasingly serious in Victoria, whereas blackleg of crucifers (*P. lingam*) is now of minor importance. Generally speaking, the damper the district in which the beet seed is produced, the higher is the percentage infected with *P. betae*. The majority of beet seed crops grown in southern Victoria in the 1942–3 season were infected to a varying degree with *P. betae*; when samples of seed from one red beet crop were sown under experimental conditions, up to 80 per cent. of the seedlings were destroyed by the fungus. Although no really effective means of disinfecting beet seed is known at present, treatment with any organic mercury dust will increase the rate of emergence. It is also recommended that a crop rotation of two or three years between beet crops should be practised.

Damping-off of flax seedlings, caused by a species of *Pythium* [cf. ibid., xvi, p. 611], is reported to have occurred to a limited extent in Victoria in the past two

seasons. The disease is favoured by any condition which delays the emergence and early growth of the seedlings, namely, excessive soil moisture, cold weather, deep sowing in heavy, acid soils, and the setting of the surface of the soil after rains. The diseased seedlings show a reddish-tan to brick-red discoloration on the cotyledons or the young roots, both of which rot completely before emergence in severe cases.

WILKINS (W. H.) & HARRIS (G. C. M.). **Investigation into the production of bacteriostatic substances by fungi. Preliminary examination of a second 100 fungal species.**—*Brit. J. exp. Path.*, xxiv, 4, pp. 141–143, 1943.

In further studies on the antibacterial properties of a second 100 fungi [*R.A.M.*, xxii, p. 13], *Penicillium expansum*, *P. gladioli*, and five other *P.* spp. inhibited the growth of all three test organisms, viz., *Bacterium coli*, *Staphylococcus aureus*, and *Pseudomonas pyocyanea*; 14 fungi, including *Phytophthora erythroseptica* and *Sclerotinia minor*, were antagonistic to the two first-named bacteria, and 15 to one only of the three, the remainder giving negative results.

WILKINS (W. H.) & HARRIS (G. C. M.). **Investigation into the production of bacteriostatic substances by fungi. II. A method of estimating the potency and specificity of the substances produced.**—*Ann. appl. Biol.*, xxx, 3, pp. 226–229, 1 pl., 1943.

The following 'zonation' method for estimating the degree of potency and the specificity of bacteriostatic substances produced by fungi, based on the examination of several hundred species over a period of two years [see preceding abstract], has been evolved by the authors and used in the University Department of Botany, Oxford, since 1941. The test is made against *Bacterium coli* and *Staphylococcus aureus* and consists in placing a few drops of the bacteriostatic substance to be tested in a hole cut with a sterile cork borer at the centre of a plate of bacteria-incorporated agar and in measuring the resultant zone of inhibition, which varies in width in proportion to the concentration of the substance. The accuracy of the method was statistically proved with the help of a standard inhibitor (mercuric chloride), and close correlation was established between the new and the standard 'dilution' method.

POUND (F. J.). **Cacao and witches' broom disease (Marasmius perniciosus). Report on a recent visit to the Amazon territory of Peru, September, 1942–February, 1943.**—14 pp., 1 diag., 1 map, Trinidad and Tobago, A. L. Rhodes, 1943.

This is an expanded account, preceded by a covering statement by R. O. Williams, Acting Director of Agriculture, Trinidad, of F. J. Pound's visit to Peru in connexion with the breeding of cacao for resistance to witches' broom (*Marasmius perniciosus*), a preliminary note on which has already appeared [*R.A.M.*, xxii, p. 346]. As a result of this survey, in conjunction with the records from previous expeditions, the present distribution of the disease may be defined as follows. On the eastern side of the Andes it occurs along the Rio Urubamba in Peru to beyond the borders of Bolivia, the Rios Napo, Putumayo, Caqueta, and Ortegaza, and the Orinoco down to the delta. The Eastern and Western Cordilleras appear to form an effective barrier to the ingress of the pathogen into the main cacao-producing regions of Colombia and Venezuela. The infected zone thus comprises the coastal plain of Ecuador, the Amazon and Orinoco River systems, and the Guianas between them. In the light of present knowledge, it seems more likely that the original focus of witches' broom was in the Amazon Valley, possibly in the vicinity of Iquitos, rather than in Surinam, as formerly supposed.

While *M. perniciosus* is absent at elevations above 1,000 ft. in the Northern Range hillsides of Trinidad, at a latitude of 11° north of the Equator and with a

rainfall of 100 in., it occurs in the Atlantic foothills of the Peruvian Andes on the Equator at 2,000 ft. with considerably heavier precipitation. Under drier conditions (30 to 40 in. rainfall per annum), the disease does not develop at 3,000 ft., while at 11° north it is unimportant or non-existent at 1,000 ft. notwithstanding high humidity. Exposure is another factor that appears to affect the expression of resistance to witches' broom. In Ecuador, for example, the contrasts in disease incidence were sharper under illumination than in the shade, i.e., more trees were resistant than would be expected and some more heavily infected. In general, there are more trees in the lightly infected class under exposed than under shaded conditions. At the same time, all the large trees located with only one or two brooms were growing partially or entirely in the shade, thereby arousing a suspicion that on a more exposed site they might have shown no trace of the disease. For this reason only a few very well-developed disease-free exposed trees were included in the selection list. It would appear from these and other considerations that cacao trees possessing a genetic basis for resistance may, by cultivation in areas where heavy infection is improbable, acquire complete freedom from witches' broom.

It would be unsafe to conclude that the selected South American material is necessarily suitable for general planting under the different conditions prevailing in Trinidad, and a propagating unit has been constructed at Marper Estate, on the Island, for the application of stringent tests to determine the capacity for resistance, yield, and quality of the product of the vegetative progeny. Efforts are further being made to test promising clones under a variety of conditions in Trinidad, and before leaving Peru the writer laid down at Iquitos a simple demonstration trial of the 32 trees selected during the 1942 expedition. It is hoped by this means to provide sufficient material within a few years for wholesale distribution to estates on which the soil and other conditions are adapted to cacao cultivation.

FISCHER (G. W.) & HOLTON (C. S.). **Studies of the susceptibility of forage grasses to cereal smut fungi. IV. Cross-inoculation experiments with Urocystis tritici, U. occulta, and U. agropyri.**—*Phytopathology*, xxxiii, 10, pp. 910–921, 1943.

This is an expanded, fully tabulated account of the writers' cross-inoculation tests at the Washington Agricultural Experiment Station with spores of the wheat, rye, and grass smuts (*Urocystis tritici*, *U. occulta*, and *U. agropyri*) on a number of forage grasses, a preliminary note on the earlier series of which has already appeared [*R.A.M.*, xxi, p. 293], supplemented by more recent information on the reactions to the same pathogens of certain wheat and rye varieties and cereal × grass hybrids.

U. tritici was more or less pathogenic to *Agropyron caninum*, *A. dasystachyum*, *A. desertorum*, *A. inerme*, *A. repens*, *A. semicostatum*, *A. spicatum*, *A. trachycaulum*, *Elymus canadensis*, *E. glaucus*, *E. triticoides*, and *Hordeum jubatum* var. *caespitosum*, while *A. caninum*, *A. inerme*, *E. canadensis*, and *E. triticoides* were susceptible in varying degrees to *U. occulta*.

U. agropyri is believed to consist of a number of physiologic races, three of which were represented in the four collections used in the tests and designated C-I, C-H, and C-F from *A. trachycaulum*, *H. jubatum*, and *A. repens*, respectively. An anomalous position was occupied by the collection C-9 from *Poa ampla*, which failed to infect any of the 28 species of grasses inoculated, probably owing to the absence of germinable spores.

Kanred × Hard Federation C.I. 10092 wheat contracted slight infection by *U. agropyri* in one out of three tests, and the smut thus produced was readily propagated on the same variety. *U. occulta* did not attack wheat nor *U. tritici* rye, the latter being also apparently immune from *U. agropyri*.

The outcome of these trials is considered to indicate a genetic connexion between *U. agropyri* and *U. tritici*, in which *U. occulta* may likewise be concerned. *U. tritici*

is thought to have arisen in the form of strains of *U. agropyri* capable of attacking wheat [ibid., xxii, p. 245], in which case the outbreaks of wheat flag smut in the United States would be traceable to the widespread indigenous disease on grasses and not to introduced material. The author therefore proposes the consolidation of the flag smuts of wheat and grasses under the binomial having priority, i.e., *U. agropyri*.

Noll (A.). **Über eine durch Gelbrostinfektion in resistenten Getreidesorten und durch andere Ursachen hervorgerufene wundgummiartige Substanz.** [On a wound-gum-like substance produced in resistant cereal varieties through yellow rust infection and other causes.]—*Zbl. Bakt.*, Abt. 2, cv, 23–24, pp. 448–459, 1 fig., 1943.

At the Gliesmarode (Brunswick) branch of the Biological Institute the writer detected the presence in the tissues of immune and resistant wheat (Rouge prolifique barbu, Spalding's Prolific, and Chinese 166) and barley (Heil's Franken and Bethge's III) varieties inoculated with *Puccinia glumarum* of a substance characterized by insolubility in strong acids and alkalies, destructibility by chlorine-containing oxidizers, and weak reaction to aniline dyes, in contrast to the rest of the tissue, these relationships being reversed, however, by a preliminary treatment with potash lye and cotton blue [*R.A.M.*, xxii, p. 409]. The results of small-scale greenhouse experiments indicated the possibility of predicting the mature reaction of a given variety to yellow rust by the distribution in inoculated seedling tissues of the nearly colourless to dirty yellow, later brown gum. Thus, in immune varieties, it is usually present only in and immediately surrounding the guard cells of the leaf and one to a few mesophyll cells below the stomata, whereas in the resistant it is deposited, following the course of the hyphae, not only in the tissues adjoining the infected stomata but in more or less extensive areas of the leaf, especially the mesophyll. Even in highly susceptible varieties the gum develops in the stomatal apertures, the sole exceptions being such extreme cases as the pure IV type of infection represented by Michigan Amber inoculated with physiologic race 1. A remarkable feature of the substance is the rapidity of its formation, its presence in the stomata often being discernible before the fungus has even initiated the first step towards infection, i.e., the production of vesicles beneath the stomata, and 24 hours earlier than any trace of mycelium could be expected to develop under favourable conditions.

Further experiments with *P. triticina*, *Helminthosporium gramineum*, *Melampsora lini*, *Erysiphe graminis*, and other fungi and bacteria yielded similar results to the foregoing as regards the development of the gum, which is interpreted, on the basis of its chemical reactions, as wound gum. Hence it is apparently non-specific.

Stakman (E. C.), Loegering (W. Q.), Cassell (R. C.), & Hines (L.). **Population trends of physiologic races of Puccinia graminis tritici in the United States for the period 1930 to 1941.**—*Phytopathology*, xxxiii, 10, pp. 884–898, 3 figs., 3 graphs, 1943.

Some of the information presented in this 12-year survey of population trends of physiologic races of *Puccinia graminis tritici* in the United States has already been noticed from other sources [*R.A.M.*, xi, p. 436; xvii, p. 381, *et passim*]. During the period under review, 1930 to 1941 inclusive, five races have ranked first in prevalence and amount, in one or more years, viz., 36, 38, 49, 56, and 17, of which the first three were of major importance in the first half of the decade 1930 to 1939, while 56 took their place from 1934 to 1940, when it began to decline and race 17 assumed an upward trend: at the present time, 56 and 17 appear to constitute at least 90 per cent. of the inoculum in the Mississippi Basin. The phenomenal increase in incidence of race 56 from 1934 onwards has led to the exclusion of Ceres from the

resistant class of wheat varieties [ibid., xxii, p. 189], and its replacement by Thatcher, which is resistant to 56 and immune from 17.

The population shifts of physiologic races show the need for replication in time and space in varietal tests for stem rust resistance, unless the varieties are exposed to artificial epidemics by inoculating with all races likely to occur in the region for which the variety is intended. The importance of barberries in the production and perpetuation of physiologic races of *P.g. tritici* has been discussed in connexion with earlier studies [ibid., xiii, p. 753] and the report of the physiologic race survey for 1940 (U.S. Dep. Agric., B.E.P.Q., E-522-A, 18 pp., 1942—mimeographed). In this report it is stated that during 1940 (chosen as a representative year), races 9, 10, 14, 24, 40, 55, 69, 77, 79, 83, 117, 121, 126, 140, 146, and 147 were isolated exclusively from barberries or rusted wheat in their vicinity. Barberries may definitely be held responsible for the occurrence of these races in 1940, since they were absent from Mexico, Texas, and Oklahoma, whence uredospores can be disseminated in the spring. Race 56 was recognized in the barberry area at least five years before it appeared in Texas and became established in northern Mexico. The data show the paramount importance of barberry eradication in reducing the number of races and preventing the production of new ones.

Changes in the proportion of the individual races may be gradual or sudden, and accordingly the reactions of wheat varieties in the field tend to vary directly with their changes, although the additive effects of several races and environmental conditions may be modifying factors. Little definite information is available regarding the causes of the changes in the prevalence of races.

GARRETT (S. D.). **Competition for nitrogen between the take-all fungus and the roots of crop plants.**—*Nature, Lond.*, clii, 3858, pp. 417–418, 1943.

Eight weeks after pieces of wheat straw infected by *Ophiobolus graminis* had been buried in fallow soil and in soil under trefoil [*Medicago lupulina*], mustard, and oats (250 pieces $1\frac{1}{2}$ in. long to each lot, in boxes of soil), the percentage of straws containing viable mycelium was, respectively, 68, 18, 17, and 4 per cent. It appears, therefore, likely that *O. graminis* will disappear more rapidly from soil under a non-susceptible crop than from soil kept fallow. This may explain why barley, though susceptible and liable to be severely attacked in the second or third consecutive crop, has not been found to be affected when undersown with trefoil, which makes a luxuriant growth in late summer and autumn after the barley has been cut, and is then ploughed in as a preparation for the next barley crop. The author suggests that the active growth of the trefoil after the barley has been harvested keeps the available nitrogen content of the soil at a very low level. This adversely affects the longevity of the fungus, which becomes unable to survive until the new barley crop is sown.

DIACHUN (S.), JOHNSON (E. M.), & VALLEAU (W. D.). **Colonies of Bacterium tabacum on roots of Wheat and several grasses.**—Abs. in *J. Bact.*, xlv, 6, p. 577, 1943.

Colonies of *Bacterium tabacum* [*Pseudomonas tabaca*] developed on sterile wheat seedling roots within two days of their immersion in an aqueous suspension containing some 2,000,000 bacteria per ml. Definite colonies were present on the surface of the root epidermis of 85 out of 96 inoculated plants, which appeared to sustain no appreciable injury. Severe wildfire followed the inoculation of tobacco leaves with aqueous suspensions of the infected wheat roots. Kentucky bluegrass [*Poa pratensis*] roots were more resistant than wheat to infection by *P. tabaca*, only an occasional plant contracting the disease when the inoculum contained 2,000,000 bacteria per ml.; however, an increase in the concentration up to 20,000,000 resulted in an incidence of 20 to 40 per cent. Rye grass [*Lolium*

perenne], timothy [*Phleum pratense*], and redtop [*Agrostis vulgaris*] were intermediate in their reactions to *P. tabaca*.

STAKMAN (E. C.), KERNKAMP (M. F.), KING (T. H.), & MARTIN (W. J.). **Genetic factors for mutability and mutant characters in Ustilago zeae.**—*Amer. J. Bot.*, xxx, 1, pp. 37–48, 5 figs., 1 diag., 1943.

At the Minnesota Agricultural Experiment Station a cross was made between two haploid lines of maize smut (*Ustilago zeae*) [*R.A.M.*, xxiii, p. 13 and next abstract] with several contrasting cultural characters. The four primary sporidia isolated from the promycelium of a single resultant chlamydospore gave rise to four F_1 monosporidial lines presenting conclusive evidence of 2 : 2 segregation for sex, colour, growth type, topography, and tendency to sectoring. A thorough study was made of cultures of the 25 sporidia isolated from each of these lines, with the exception of one from line 4 which died, and it was found that all lines derived from the monosporidial lines 1 and 2 were alike, as also were those originating from 3 and 4. This result is interpreted as denoting the completion of segregation before the abjointing of the primary sporidia and the constitution by the progeny of single sporidia of a clone or biotype in the absence of mutation.

Each F_1 line was grown on potato dextrose agar in duplicate flasks and no sector variants developed in about 100 colonies of lines proceeding from sporidia 1 and 2, whereas in those arising from 3 and 4 there were some 360 mutants in a comparable number of colonies. A study of the F_2 progeny of a cross between two F_1 lines with contrasting attributes indicated clear segregation for several of these, including sex and mutability, although all lines obtained from the promycelia of three of the eleven chlamydospores were diploid. The absence of reduction division in these individuals was later shown to be associated with a tendency to autolysis of the promycelia conferred by some factor or factors inherent in certain constant haploid lines.

The F_2 offspring comprised some lines remaining constant under all normal conditions and others varying in different degrees. Constant × constant and variable × variable crosses were made among these lines, and segregation for the two characters occurred in the F_3, with a tendency for the former to produce constant and the latter variable segregates: one constant × constant cross yielded all constant progeny. All F_5 segregates from a series of variable × variable crosses were variable, as also were the 34 proceeding from a back-cross between an F_5 and an F_4 variable line. The constant × constant series presented some difficulty connected with the factor for lysis in most of the lines involved, but this was eventually overcome and virtually complete constancy attained in the F_8.

Some lines are strictly sporidial, others strictly mycelial, and others sporidial-mycelial; the change from sporidial to mycelial is not to be confused with the production of true variants. The heritable basis of mutability in *U. zeae* is apparent from the results of crosses of mutants and their parents with the same lines of opposite sex, evidence to this effect being adduced in connexion with a white mutant, 1OK2-1, that arose in a brownish colony of a monosporidial, unisexual line. All crosses between this mutant and its white derivatives gave rise to some white segregates, which never appeared, on the other hand, among the offspring of crosses involving the parent line. Only two of the 83 white or nearly white lines proceeding from the original white mutant appeared to be culturally identical under comparable conditions. No combination of the numerous white lines derived from 1OK2-1 produced chlamydospores, though some gave rise to large galls on maize plants, indicating that the factors for sex and pathogenicity are not the same, and that the parasitic dicaryophase is not necessarily succeeded by the diplophase.

An indefinite number of biotypes may be obtained by the isolation of mutants

from sector variants in mutable lines. Mutation may occur in respect of almost every observable character, the mutants differing from their progenitors and among themselves very decidedly or in practically imperceptible gradations. The combinations arising from crosses between monosporidial lines also yield innumerable biotypes of *U. zeae*. In the writers' extensive series of hybridizations, all the haploid segregates of a cross were not infrequently observed to be different, while in the progeny of many crosses even the parental lines were not represented.

At least 5,000 readily distinguishable biotypes arose from two haploid sporidia of opposite sex and contrasting characters, and it is concluded that the maize smut comprises an unlimited number of such variants, which are, moreover, continually being produced as a result of mutation and of recombinations developing from inter-biotypic hybridization. The latter process is of frequent occurrence, and in some of the resultant biotypes mutation is almost incredibly common. The species consequently presents an extraordinary range of diversity. Equally remarkable, however, is the homogeneity of the chlamydospores, regardless of the particular cross producing them or the time and place of their development in nature.

Stakman (E. C.), Kernkamp (M. F.), Martin (W. J.), & King (T. H.). **The inheritance of a white mutant character in Ustilago zeae.**—*Phytopathology*, xxxiii, 10, pp. 943–949, 2 figs., 1943.

This is an abridged account of the authors' studies on the inheritance of a white mutant character in maize smut (*Ustilago zeae*), fuller details of which were published elsewhere [see preceding abstract]. This paper emphasizes the significance of the failure to obtain functional chlamydospores from crosses between the white offspring of the original white mutant, which is interpreted as an indication of the existence of multiple factors for sex. It is suggested that the nuclei of certain white lines possess the necessary factors for attraction and association enabling them to produce the dicaryophase, but not those leading to complete sexual fusion. This and other evidence of a similar nature points to gradations in the degree of 'maleness' and 'femaleness', in so far as such terms are applicable to an organism like *U. zeae*, which appears to be entirely isogamous.

Fawcett (H. S.) & Bitancourt (A. A.). **Comparative symptomatology of psorosis varieties on Citrus in California.**—*Phytopathology*, xxxiii, 10, pp. 837–864, 14 figs., 1943.

The term 'psorosis' is extended to cover a group of similar disorders of citrus, previously believed to be of independent origin but now attributed to different manifestations of a single virus *Citrivir psorosis*, viz., psorosis A and B [*R.A.M.*, xx, p. 175], blind-pocket psorosis, concave-gum psorosis [ibid., xx, p. 360], and crinkly-leaf psorosis (Color handbook of Citrus diseases, 1941) [ibid., xxii, p. 131]. A common feature of all these variants of psorosis is a white to yellowish, mosaic-like flecking of the veinal region or cleared bands along the veins and veinlets of the young leaves, accompanied by fundamentally similar changes in the wood giving rise to such primary symptoms.

Psorosis A and B (*C. psorosis* vars. *vulgare* and *annulatum*, respectively) cause, besides the above-mentioned young-leaf symptoms, (*a*) bark lesions, characterized either by a dry irregular flaking-off of the outer cortex, or by dry, erumpent pustules; and (*b*) two kinds of wood lesions [see next abstract], namely, primary infections near the cambium, consisting of layers of gum between layers of wood directly beneath the bark lesions, and secondary damage in the form of discoloured wood, mainly further inwards, these and the contiguous areas of externally healthy wood being devoid of starch and impermeable to the passage of water. Psorosis B differs from A in the production of more rapidly developing and more continuous

areas of cortical scaling, of larger numbers of twig lesions, and of ringed spots on the mature foliage and fruit.

Concave-gum psorosis (*C. psorosis* var. *concavum*) [cf. ibid., xxii, p. 384] induces the formation of cavities due to the inhibition or retardation of wood growth in restricted areas of the trunk or large branches. The gum layers accumulating in the wood in this form of the disease are similar to those of A and B, but more localized.

Blind-pocket psorosis (*C. psorosis* var. *alveatum*) may usually be recognized by the appearance of trough-like straight- or convex-sided depressions in the trunk or limbs, associated with the inhibition of wood growth within even narrower limits than in the case of concave gum. Below the lesion, the loose wood parenchyma is usually impregnated with a waxy or gummy substance.

Broadly speaking, the primary lesions in the wood caused by the four variants of psorosis under discussion are similar, except for the extent of the resultant alterations, which are intensive but narrowly localized in blind pocket, somewhat more diffuse in concave gum, and widespread in A and B, sometimes even involving girdling of the trunk and limbs.

Crinkly-leaf psorosis, which chiefly affects lemons, causes a warping and pocketing of fully-grown leaves besides the young-leaf symptoms. The fruits of affected trees tend to be rough, coarse, and irregularly bumpy. Distinctive bark or wood symptoms are absent. Another disturbance principally affecting lemons is infectious variegation, characterized by irregular, chlorotic areas on the leaf blade and provisionally regarded as an occasional feature of the crinkly-leaf complex, both types usually being found in conjunction with psorosis A.

Corky bark, of which there are five types, namely, necrotic cavity, crumbly gum, banded, circular spot, and tattoo-netted, and knobby bark may also be virus effects related to the foregoing: all were observed on oranges.

BITANCOURT (A. A.), FAWCETT (H. S.), & WALLACE (J. M.). **The relations of wood alterations in psorosis of Citrus to tree deterioration.**—*Phytopathology*, xxxiii, 10, pp. 865–883, 9 figs., 1943.

This is an expanded account of the writers' experiments to determine the relation of the wood alterations in citrus psorosis [see preceding abstract] to tree decline, a preliminary note on which has already appeared [*R.A.M.*, xxii, p. 62].

HENDRICKX (F.). **Colletotrichum ou Antestia?** [*Colletotrichum* or *Antestia*?].—*Publ. Inst. nat. Étude agron. Congo belge*, Sér. sci., 26, pp. 10–16, 2 figs., 1942.

The examination during the season of 1938–9 of thousands of coffee berries convinced the author that much of the damage attributed to infestation by *Antestia* sp. in the Belgian Congo is in reality due to *Glomerella cingulata* [*R.A.M.*, xix, p. 330], mainly in its conidial stage (*Colletotrichum coffeanum*). The perfect phase has not yet been observed under natural conditions in the Kivu, though it developed in pure culture; its part in the perpetuation of infection is in any case believed to be subordinate. Berries attacked at an early age fail to develop and are totally unmarketable, being converted into a blackish mass. The spots on the green berries are sunken, brownish-yellow, darker in the centre than round the periphery, later turning dark brown, expanding, and becoming covered with the black pycnidia of the fungus, from which masses of unicellular, hyaline, oblong to slightly reniform conidia are liberated. The lesions on the ripening fruits are uniformly black, depressed, and sticky to the touch; at this stage the fructifications raise minute vesicles on the epidermis, which they ultimately rupture. Humidity seems to be the most important meteorological factor affecting the development of *G. cingulata*, renewed outbreaks of which appear to be invariably associated with showers of rain.

Of the three agents of stigmatomycosis entering the berries through the punctures

by the Pentatomid *Antestia*, namely, *Nematospora coryli*, *Ashbya* [*N.*] *gossypii*, and *Spermophthora gossypii*, only the first-named has so far been observed locally.

In order to ascertain the extent of damage to the crop caused by a late attack of *G. cingulata*, five batches, each consisting of 100 ripening berries bearing the fruit bodies of the fungus, were chosen at random from the plots of the Mulungu plantation and the 965 beans they contained divided into two groups, floating (due to partial or total disorganization of the endosperm) and normal, representing 13·6 and 86·4 per cent., respectively, of the total number. The normal group comprised 6·37 per cent. *Antestia* infestation, manifested by the presence of *N. coryli* at the sites of the punctures. No symptoms were apparent on 80·65 per cent. of the normal or on 69·70 per cent. of the total number of beans attacked by *G. cingulata* at approaching maturity, and in no case was the mycelium of the fungus detected in the interior of the spermoderm. Hence it is concluded that late invasion by *G. cingulata* is incapable of inducing destruction of the seed, a fact which in no way minimizes the risk of serious losses from early infection of the still milky endosperm by the parasite.

Arny (A. C.). **Flax varieties registered, I.**—*J. Amer. Soc. Agron.*, xxxv, 9, pp. 823–824, 1943.

Particulars are given of the first two flax varieties to be approved for registration in the United States, Biwing Reg. No. 1 and Redson Reg. No. 2, which are selections from the cross Bison×Redwing made in 1929 at University Farm, St. Paul, Minnesota. The wilt (*Fusarium lini*) percentages of Biwing and Redson were 9 and 3, respectively, compared with 23 and 9 for Bison and Redwing, respectively. The reactions of the two new varieties to rust (*Melampsora lini*) were classified as moderate— and moderate+, respectively, those of Redwing and Bison being moderate— and heavy—, respectively, while both the selections were placed in the light± category for reaction to 'pasmo' (*Phlyctaena linicola* [*sphaerella linorum*]), the incidence of which in Redwing was moderate and in Bison light.

Robinson (B. B.). **Greenhouse seed treatment studies on Hemp.**—*J. Amer. Soc. Agron.*, xxxv, 10, pp. 910–914, 1943.

The Bureau of Plant Industry having been requested to determine the benefits, if any, of seed treatment of hemp, an important war-time crop which has hitherto been little injured by disease, co-operative greenhouse trials were conducted in Illinois, Wisconsin, South Carolina, Mississippi, and Maryland, the choice of plant-protectives being left to the discretion of the local organizers. Generally speaking, emergence was improved by the ten dusts used at the prescribed concentrations, though some damage was caused in Wisconsin by ceresan. The price of hemp seed ranges from \$5 to over \$10 per bush. of 44 lb., and the recommended rate of sowing is 55 lb. per acre, so that for such valuable seed precautionary treatment may be well worth while.

Massey (L. M.). **The black-spot war situation. Tests with fungicides for black-spot.**—*Amer. Rose Annu., 1943*, pp. 141–154, 1943.

The results of trials in the control of rose black spot [*Diplocarpon rosae*] at the New York (Cornell) Agricultural Experiment Station in 1941–2 were reasonably consistent and in general agreement with those of previous years [*R.A.M.*, xviii, p. 598]. Both copper- and sulphur-containing dusts and sprays gave adequate control. To cite some figures, in 1941 the mean number of diseased leaflets was reduced from 346 in the controls to 0·0, 0·0, 1·3, and 4·7 by 325-mesh sulphur with 3·4 per cent. copper dust, Koppers' flotation sulphur dust, 'mike' sulphur dust with 3·4 per cent. copper, and red copper oxide dust, respectively, while in 1942 the best results were given by micronized sulphur with 6·8 per cent. copper (4·5

spotted leaflets compared with 80·4 in the checks). Fermate, used in the latter year only, reduced the number of infected leaflets to 16·8. In mixtures of copper- and sulphur-containing materials it is advisable to limit the former component to 3·4 per cent. in view of the risk of burning.

BAKER (K. F.). **Sphaerotheca humuli var. fuliginea on Delphinium in California.**—*Phytopathology*, xxxiii, 9, pp. 832–834, 1943.

Sphaerotheca humuli var. *fuliginea* appears from an examination of herbarium specimens to have been present on cultivated and wild species of *Delphinium* in California for at least 19 years, though this is the first published record of its occurrence on the host in question or other Ranunculaceae in North America. The fungus has, however, been reported on *D. grandiflorum*, *Paeonia anomala*, *Thalictrum minus*, and *T. simplex* in the U.S.S.R., *T. alpinum* in Norway and Sweden, and *Trollius europaeus* in Italy [*R.A.M.*, xiii, p. 127]. The perithecia of the specimens collected on *D. amabile* at Los Angeles measured 60 to 89 (average 76·3) μ in diameter, with conspicuous wall cells, 13 to 28 (21·3) μ in width, the asci 46 to 88 by 43 to 71 (63·7 by 56·8) μ, and the ascospores 13 to 26 by 13 to 18 (18·1 by 14·5) μ. *S. humuli* var. *fuliginea* is readily distinguishable from *Erysiphe polygoni* on the same hosts by its large, convex, comparatively pale perithecial wall cells, with deeply indented sutures, sparse mycelial development, and concatenate conidia.

ROSSETTI (VICTORIA). **Podridão preta das Orquideas.** [Black rot of Orchids.]—*Biológico*, ix, 8, pp. 201–205, 3 figs., 1943.

Species of *Laelia* in the orchid plantings of Buenos Aires have recently been severely damaged by a Phycomycete, the vegetative growth habit of which in pure culture on potato dextrose agar is reminiscent in some respects of *Phytophthora parasitica* and in others of a *Pythium*. A closer identification is impracticable pending the development of fructifications. The disease is characterized by a dark brown, flaccid rot of the pseudo-bulb tissues, which are subsequently invaded and still further disorganized by saprophytic fungi and bacteria, and a sharply defined, black discoloration of the leaves, forming a striking contrast to the brilliant green of the normal foliage. The infected leaves fall at the slightest contact, and the fungus continues to develop until they are completely blackened; the pseudo-bulbs remain attached to the rhizome and ultimately become mummified. Inoculation experiments on the wounded pseudo-bulbs and leaves of *L. purpurea* and *L. crispa* gave positive results, the pathogen being reisolated from the infected tissues. A serious feature of the disease is its rapid spread, one grower, for instance, having lost 300 plants in 20 days. A suspected plant should therefore immediately be removed, while another precautionary measure (for large-scale use only) consists in the excision of the rhizomes and transplantation to a fresh, healthy site, where the plants must be kept dry, supplied with ample ventilation, and gradually exposed to the sun.

WOLF (F. A.). **The perfect stage of Cercospora sordida.**—*Mycologia*, xxxv, 5, pp. 503–509, 1 fig., 1943.

The author observed on decaying leaves of trumpet creeper (*Tecoma radicans*) the perithecial stage of *Cercospora sordida*, which he describes under the name *Mycosphaerella tecomae* n.sp. Cultures from ascospores were identical with those from conidia and yielded *Cercospora* conidia, which were also abundantly produced from the ostiolar region of the perithecia of *M. tecomae*.

GREENALL (A. F.). **Low germination of perennial Ryegrass seed in South Otago.**—*N. Z. J. Agric.*, lxvii, 2, pp. 79–81, 1943.

Considerable losses were experienced during the past two seasons in South Otago, New Zealand, as a result of low germination in rye grass [*Lolium perenne* and *L. multiflorum*] due to the blind seed fungus [*Phialea mucosa*: *R.A.M.*, xxii, p. 171]. It has become increasingly apparent that climate, and particularly humidity, exercise a great influence on the severity of attack. In tests carried out by the Seed Testing Station, Palmerston North, a correlation was found to exist between the percentage of immature uninfected seed and the percentage of germinating seed in the machine-dressed sample. Thus, when a sample contained 86 per cent. uninfected seed the germination of the machine-dressed seed was 66 per cent., while when there was only from 5 to 17 per cent. uninfected seed, the germination of the machine-dressed seed was only 12 per cent. It is suggested that a test should be made on all fields of rye grass prior to their being cut in order to ascertain the probable germination. From the results of this test, growers will be able to decide whether the expected germination warrants threshing and machine-dressing.

SPRAGUE (M. A.) & GRABER (L. F.). **Ice sheet injury to Alfalfa.**—*J. Amer. Soc. Agron.*, xxxv, 10, pp. 881–894, 2 figs., 1 graph, 1943.

As a result of ice sheet formation following sleet storms in south-eastern Wisconsin in February, 1937, the lucerne stands on 237,000 acres (about one-fifth of the total area under the crop in the State) were so severely thinned and injured as to be of no commercial value for hay. A full report is given of storage trials providing conclusive evidence that the damage was due to the inadequate diffusion of carbon dioxide, increasing concentrations and pressures of which induced a toxic condition in the plants. Dormant cold-hardened plants frozen and maintained in blocks of ice were weakened after 12 and dead within 20 to 26 days. Circulating water permitted complete survival and vigorous growth after 60 days of storage, while plants confined in still water were enfeebled after 30 days and dead after 60 at 1° C. Circulating atmospheres of 25 or 50 per cent. carbon dioxide in air caused some weakening at 21, 27, and 35 days and were lethal at 54, while plants stored in 0, 5, and 10 per cent. mixtures all showed fair survival and growth after 54 days.

PADWICK (G. W.) & AZMATULLAH (M.). **Claviceps purpurea (Fr.) Tul. and a new species from Simla.**—*Curr. Sci.*, xii, 9, p. 257, 1943.

Claviceps viridis Padwick & Azmatullah n.sp. is the name applied to an ergot fungus the sclerotia of which were collected immediately below the grass *Oplismenus compositus* at Simla in August, 1942, about a fortnight after the detection of *C. purpurea* on *Brachypodium sylvaticum*, already recorded as the host of a *C.* sp. in 1941 [*R.A.M.*, xxi, p. 206]. The new species is characterized by green or greenish-black, cylindrical, curved sclerotia, 6·4 by 1·3 (4 to 10 by 1 to 1·5) mm.; yellowish-green, tuberculate capitula, 1 to 1·6 mm. in diameter, borne on yellow stipes up to 4·2 cm. in length; perithecia 280 to 351 by 170 to 229 (322 by 203) μ; ovate, cylindrical asci with rounded apices and tapering bases, 148 to 242 by 2 to 3·1 (178 by 2·6) μ; and ascospores 119 to 188 (145) μ. The conidia are hyaline or pale green, globose or cylindrical, straight or curved, and measure 4·2 to 18·9 by 3·4 to 4·6 (8·4 by 3·8) μ. The fungus was cultured on potato dextrose agar, on which it slowly formed profusely convoluted, greenish-yellow, later darker green colonies, consisting largely of masses of conidia, somewhat smaller than those developing in nature, viz., 3·3 to 12·6 by 1·6 to 3·8 (9·8 by 2·4) μ.

Keitt (G. W.), Langford (M. H.), & Shay (J. R.). **Venturia inaequalis (Cke.) Wint. II. Genetic studies on pathogenicity and certain mutant characters.**—*Amer. J. Bot.*, xxx, 7, pp. 491–500, 3 pl., 1943.

Continuing their earlier investigations [*R.A.M.*, xxi, p. 208] on the inheritance of pathogenicity of certain mutant characters in *Venturia inaequalis*, using mono-ascosporic lines freshly isolated from perithecia occurring in nature, the authors found only two types of pathogenic reaction to greenhouse inoculations of potted apple trees, viz., lesion, in which typical sporulating lesions were produced, and fleck, in which yellowish flecks (mostly without sporulation, occasionally with scanty sporulation) developed. The two mutant characters studied, 'tan' and 'non-conidial', arise *in vitro* in sectors of cultures. The former differed from normal in its tan colour in culture and its reduced conidial production; it suppressed all macroscopic expression of pathogenicity, lines carrying 'tan' inciting neither lesions nor flecks. The 'non-conidial' differed from normal in producing no conidia (though some lines produced them very sparsely), and in the reduced diameter of the hyphae in cultures *in vitro*; it suppressed all macroscopic expression of pathogenicity in all apple varieties studied except McIntosh, in which the lesion reaction was modified to fleck.

The results were as follows. Lesion × lesion, fleck × fleck, and lesion × fleck crosses between mono-ascosporic lines which had shown no perceptible change in culture ('normal') produced asci with the normal number of spores. In a given apple variety, crosses of lesion × lesion lines gave all eight lines lesion, fleck × fleck, eight lines fleck; lesion × fleck, four lines lesion and four fleck. In all cases, segregation of factors for pathogenicity, as determined by the lesion and the fleck reactions, were in the ratio 1 : 1. Occasionally, 3 : 1 phenotypic ratios occurred, and with some isolate-variety combinations the lesion and fleck reactions merged. This indicates that modifying factors may sometimes operate.

Normal × normal gave asci containing 8 normal lines. Normal × tan gave asci containing 4 lines normal and 4 lines tan. All lines carrying tan were non-infectious. The evidence also showed that mutation to tan entirely suppressed the expression of the factor for pathogenicity. Normal × tan non-conidial gave asci containing the lines that would be expected from a cross involving two characters, viz., tan, non-conidial, tan non-conidial, and normal. Different combinations of characters occurred in the different asci, but in any given ascus the factors for tan and non-conidial, respectively, segregated from their alleles in 1 : 1 ratio. As in the normal × tan cross, all lines carrying tan were non-infectious on all varieties tested. Lines carrying non-conidial without tan were non-infectious on all varieties tested except McIntosh, on which they produced flecks. Other evidence showed that mutation to non-conidial did not occur at the locus of the gene for pathogenicity.

Wilkinson (E. H.). **Perennial canker of Apple trees in England.**—*Gdnrs' Chron.*, Ser. 3, cxiv, 2966, p. 159, 2 figs. (1 on p. 161), 1943.

The fungus causing the die-back and canker of apple branches recently described by the author [*R.A.M.*, xxi, p. 419] has been found to agree perfectly with *Gloeosporium* (*Neofabraea*) *perennans* [ibid., xxii, p. 29]. The spores, taken from cankers in fruits, measure 6 to 21 by 1·5 to 6 μ. Suspended in distilled water and 0·1 per cent. sucrose solution, they readily germinate, and after about 70 hours, small secondary conidia are budded from the growing hyphae and become dispersed in the solutions. In distilled water and 0·1 per cent. sucrose solution they measure, respectively, 3 to 6 by 1·5 (average, 5 by 1·5) μ and 3 to 9 by 1·5 to 3 (average, 5·9 by 1·8) μ.

The disease affects Worcester Pearmain, Bramley's Seedling, Allington Pippin, Laxton's Superb, and Cox's Orange Pippin apples in Cheshire, Cambridgeshire, Worcestershire, and Somersetshire. The only serious outbreak of the canker phase

was that recorded from Worcestershire [ibid., xxi, p. 419], but minor outbreaks have occurred at Cropthorne, in the same county, and at Long Ashton, both developing after the orchards had been summer pruned. Trees not summer-pruned in the Worcestershire orchard were completely free from infection, but four of these pruned in July, 1942, showed most of the cuts infected by the following September.

A pure culture of the fungus, when inoculated into the cut surfaces of apple branches, rapidly produces cankers characterized by a peeling away of the periderm with exposure of the cortical tissues, which turn black. The fruiting bodies appear over the exposed surface of the cortex of the younger branches and protrude through the bark on older branches to produce white, glutinous masses of spores.

Three species of *Gloeosporium* are known to produce apple lenticel rots in Great Britain, viz., *G. album*, *G.* (*N.*) *perennans*, and *G. fructigenum*. The rots due to the first two are identical, but the spores of *G. album* measure 12 to 27 by 3·4 to 5 μ. *G. fructigenum* produces a more rapid rot with greyish-black surface mycelium and glutinous masses of ochraceous-buff to O-orange spores measuring 12 to 31 by 4 to 7·5 μ. Inoculations indicated that *G. album* and *G. fructigenum* are non-parasitic on apple branches.

The substitution of winter for summer pruning and the removal and burning of all affected branches during winter in the Worcestershire orchard where the outbreak was originally observed, appear to have controlled the condition completely.

WATSON (R. D.). **Some factors influencing the toxicity of ozone to fungi in cold storage.**—*Refrig. Engng*, xlvi, 2, pp. 103–106, 1 diag., 1943.

In further studies at Cornell University, Ithaca, New York, on the application of ozone to apple storage [*R.A.M.*, xxi, p. 209], the writer determined the influence of certain factors on the toxicity of the chemical to fungi.

In experiments with *Sclerotinia fructicola*, using a modification of Liu's spore germination method [ibid., xx, p. 414], the ozone (produced from pure oxygen by a metal-glass-metal dielectrode commercial ozonizer) was bubbled through conidial suspensions in towers with sintered glass plates, the duration of treatment ranging from ten seconds to 180 minutes and the concentration from 1·4 to 1,400 p.p.m. In general, when the length of the treatment was doubled, 50 per cent. of the conidia were destroyed at about half the ozone concentration originally required. The relationship, concentration of ozone in p.p.m. $\times$ time in hours $=$ constant K, held fairly well over a limited range, but not at high or low dosages. The minimum K value of 0·91 was obtained with a concentration of 14 p.p.m.

A shorter period of exposure (1 to 2 hours) to ozone was required to kill the conidia of *S. fructicola* in drops than in 5 ml. water in a 9-cm. Petri dish ($2\frac{1}{2}$ to 3). The spores in water over 2 per cent. potato dextrose agar remained viable longer (over $5\frac{1}{2}$ hours) than those with sugar and water (over 2 hours) or water alone (over half an hour); in the control series up to 99·5 per cent. germination was still occurring after 49 hours. Ozone killed either wet or dry spores of *Macrosporium* [*Stemphylium*] *sarciniforme* on the skin of apples as readily as in water, the germination percentage of the former after $3\frac{1}{2}$ hours' treatment being 6 and the latter after $1\frac{1}{2}$ hours 11. No wet spores of *Sclerotinia fructicola* or *Penicillium expansum* germinated after treatment for 2 to $2\frac{1}{2}$ hours. Temperature fluctuations between 3° and 34° C. were found to exert a very slight influence on the toxicity of ozone to *S. fructicola* spores.

Among the advantages of ozone as a fungicide are the absence of any residue except oxygen; its ability to reach the apples and inhibit mould growth within and throughout the package in places inaccessible to a non-gaseous product; its

oxidizing properties, freeing the room from odours which are readily absorbed by the fruit and may impair its flavour; at the relatively low concentrations normally used in apple storage rooms (0·4 to 2 p.p.m.), there is no risk of deleterious effects on the health of personnel. Drawbacks to the use of ozone include its failure to protect cut or damaged fruit from decay, since it is destroyed by the exposed flesh; limited rate of diffusion at the low dosages used, involving absence of toxicity to moulds or bacteria throughout liquids of considerable depth; and production of local lenticel scald on peaches at 2 and on apples at 10 p.p.m. in the case of protracted treatments. According to Gane (*Rep. Food Invest. Bd*, pp. 126–127, 1935), bananas were injured at 1·5 p.p.m., while oranges withstood a concentration of 40 p.p.m.

WILSON (E. E.) & SCOTT (C. E.). **Prevention of three Peach diseases by ferric dimethyldithiocarbamate spray.**—*Phytopathology*, xxxiii, 10, pp. 962–963, 1943.

In 1942, ferric dimethyldithiocarbamate (fermate) was tested as a spray for the control of brown rot (*Sclerotinia fructicola*), rust (*Tranzschelia* [*Puccinia*] *pruni-spinosae*), and shot hole (*Coryneum beijerinckii*) [*Clasterosporium carpophilum*] of peaches in the Sacramento Valley, California.

Two applications, 27 and 13 days, respectively, before harvesting were given in the brown rot experiments, the compound being used at the rate of 1 lb. per 100 gals. plus 4 oz. of a wetting agent. In one orchard, on the first day of picking, the incidence of infection in the treated and control blocks was 4 and 11 per cent., respectively; in another 4 and 19 per cent., respectively, the corresponding figure for lime-sulphur, 0·75–100 plus 4 oz. of a wetting agent being 8 per cent.

The numbers of rust lesions developing on the leaves of trees sprayed on 16th October with fermate 1·5–100, the same plus lime 1–100, Bordeaux mixture 10–10–100, lime-sulphur 4–100, the same 6–100, and untreated were 3, 1, 9, 1, 1, and 18 per leaf, respectively, the corresponding figures for shot hole being 5, 12, 23, 65, 14, and 156 lesions per 100 twigs, respectively.

It is pointed out that in these trials the compounds were not subjected to such a lengthy weathering period as would normally be the case in orchard practice.

HIGGINS (B. B.), WALTON (G. P.), & SKINNER (J. J.). **The effect of nitrogen fertilization on cold injury of Peach trees.**—*Bull. Ga Exp. Sta.* 226, 27 pp., 1943.

A fully tabulated account is given of a series of experiments covering the period from 1929 to 1941 to determine the influence of nitrogen fertilizers on cold injury to Elberta peach trees (nursery stock) under Georgia conditions. The most significant reduction of susceptibility was effected by the application of the nitrogenous constituent of the complete fertilizer at the rate of 8 per cent., at which level it closely approximated to a balance with other nutrients for the normal growth of peaches. The protection conferred by an adequate supply of nitrogen on the trees as a whole did not, however, extend to the buds, flowers, or young fruits. During the latter years of the investigation, the trees in the no-fertilizer (control) blocks showed significantly greater susceptibility to cold injury than those receiving phosphate and potash but no nitrogen, indicating the probability that such a reaction may be associated with the deficiency of any element requisite for healthy growth. The enhanced resistance to cold of the trees in the high-nitrogen blocks is tentatively attributed to the presence in the cambial cells of larger amounts of proteins, coupled with smaller vacuoles, to the nature of the proteins in question, or to both factors combined.

MEREDITH (C. H.). **Mercury compounds applied to Banana plants in the field.**—*Phytopathology*, xxxiii, 9, pp. 835–836, 1943.

In a further series of experiments at the Glenleigh Laboratory, Highgate P.O.,

Jamaica, on the control of banana wilt (*Fusarium oxysporum cubense*) [*R.A.M.*, xxi, p. 340], very promising results were obtained with hortosan potato dip (8 per cent. nitrophenolmercurihydroxide and chlorophenolmercurihydroxide, supplied by Imperial Chemical Industries, Ltd.). In a test in which the chemical was mixed with the soil in plots 2 ft. by 2 ft. near the plants at dosages of 2, 4, and 8 oz. per sq. ft., the total weight of the roots from the three treated plots after about seven months was 83·4 gm., compared with 79·7 gm. for the checks. Five months after the inception of the test, tubes were half-filled with soil from the treated and untreated areas, autoclaved, inoculated with the pathogen, and the growth rate compared. At the end of nine months, the three treatments permitted 1·5, 0, and 0 cm., growth of the fungus, respectively, compared with up to 4 cm. in the control series, while after 11 months the lowest concentration of hortosan was found to be no longer effectual, though the other two gave reduced development of the parasite. In a second trial, the growth of *F. oxysporum cubense* was inhibited for three and two months on acid and neutral soils, respectively, by hortosan at the rate of 1 oz. per stool, applied at the time of planting. At a dosage of 2 oz., the same compound stimulated the growth of the bananas in comparison with those on the control plots. A third experiment, in which the hortosan was sprinkled on the surface of the soil, gave inconsistent results. No injury was produced on the roots either by hortosan (2 oz.) or DuBay, mercurous chloride, and mercuric chloride (1 oz.).

SEN (P. K.), MALLIK (P. C.), & ROY (P. K.). **Toxic effect of gases on plants.**—*Sci. & Cult.*, ix, 2, pp. 87–88, 1943.

A tabulated account is given of studies carried out at the Fruit Research Station, Sabour, India, to determine the relative toxicity of three constituent gases of coal smoke, viz., sulphur dioxide, ethylene, and carbon monoxide in relation to black tip of mango [*R.A.M.*, xx, p. 313]. Pure sulphur dioxide rapidly bleaches and kills the fruit, while at concentrations from 0·5 to 10 per cent., pinkish to brick-red and finally blackish spots develop round the lenticels, the injury increasing in proportion to the strength of the gas and length of exposure. Of interest are the divergent effects of continuous and intermittent exposure, the former inducing toxic symptoms in three hours, whereas the operation of the latter for one hour in the morning (8 to 9) and evening (5 to 6) daily was without influence, even when extending over a total period of nine hours. The atmosphere surrounding the experimental trees was found to contain 0·0067 to 0·049 per cent. sulphur dioxide, as against only 0·000196 to 0·000986 per cent. in the fresh air.

In contrast to sulphur dioxide, the toxicity of ethylene reached a maximum at the lowest concentration used (1 per cent.), which induced yellowing and a deep brown to black spotting of the skin, followed by softening and dropping of the fruits. Dilute carbon monoxide exerted no ill effects, but protracted exposure to the pure gas induced pallor of the skin.

The most resistant of the experimental varieties was Champakelwa.

SCOTT (C. E.), THOMAS (H. EARL), & THOMAS (H. E.). **Boron deficiency in the Olive.**—*Phytopathology*, xxxiii, 10, pp. 933–942, 2 figs., 1943.

An olive disease in California characterized by deep pitting and shrivelling of the fruits, chlorosis of the leaf tips, a bunchy growth habit followed by die-back of the branches, and cortical protuberances, 5 to 10 mm. in length and raised 2 mm. above the level of the surrounding bark, responded favourably to branch injections, soil treatment, and spraying with boron compounds, the last-named method, however, producing only transitory effects in severe cases. Boric acid mixed with diatomaceous earth (celite) was introduced into the branches, through holes 2 in. or more in depth, by means of a 'gun' similar to that used in the treatment of lime-induced chlorosis [*R.A.M.*, x, p. 677] at dosages of ½ to 2 'shots' per hole.

A borax spray (2 to 8 lb. per 100 gals.) was applied at 400 lb. pressure, with the addition of a proprietary detergent (dreft) to the June applications to facilitate leaf-wetting. Soil treatments were mostly made broadcast in irrigation furrows. In one district, Butte County, large trees were benefited by less than ½ lb. borax per tree applied by the last-named method, but about 1 lb. appears to be required for a complete cure. Observations and tests on boron deficiency in other crops in California are briefly described.

KRAMER (M.) & DE ANDRADE (A. C.). **Estudos sôbre adesivos da calda bordaleza.** [Studies on adhesives for Bordeaux mixture.]—*Biológico*, ix, 9, pp. 317–330, 2 figs., 1943. [English summary.]

Of twelve adhesives for Bordeaux mixture tested on potatoes in the absence of early or late blight (*Alternaria solani* and *Phytophthora infestans*, respectively) in 1942 in São Paulo, Brazil, cassava flour (150 gm. per 100 l.), 'beko' fish oil (670 c.c. previously emulsified with 330 c.c. of a 20 per cent. sodium sulphite solution per 100 l.), and 'matarazzo' rice starch (150 gm.) left significantly higher percentages of copper than the control (without a spreader). Powdered soap, kaolin, and casein 120 were approximately equal to the control, while glue, resin soap, casein 60, milk, and molasses proved definitely inferior. Fish oil was particularly effective during the third, very wet experimental period, when a number of the other adjuvants failed. The Eigenheimer variety was more susceptible than Konsuragis to foliar injury, which resulted principally from treatment with resin, soap, casein, and milk.

MILLER (H. J.). **A comparison of laboratory and field retention and protective value of certain copper fungicides.**—*Phytopathology*, xxxiii, 10, pp. 899–909, 2 graphs, 1943.

The retention of a number of protective copper fungicides was determined in the laboratory at the Pennsylvania State College by direct chemical analyses of Pyralin plates sprayed under standard conditions. The resultant data showed a very high correlation with direct analytical determination of retention of the same materials on cherry leaves sprayed against *Coccomyces hiemalis* in 1940 and 1941, while very satisfactory agreement was also obtained by the spore-germination technique.

The maximum degree of retention was shown by Bordeaux mixture 2–4–100 and two formulae of tank-mix copper phosphate. Tenacity indices for the various preparations were calculated by multiplying the percentage of copper remaining on the foliage at a given sampling date by the total rainfall before this date and a total obtained by adding these three values for each of the treatments, which was then divided by the sum of the precipitation for the three weathering periods multiplied by 100 to give a value of less than 1. Computed in this way, the indices for the three above-mentioned compounds in 1940 were 0·555, 0·465, and 0·410, respectively, the corresponding figures for Tenn. '26' 3–3–100 and the same plus 1 pt. orthex, 1 pt. nufilm, 1 pt. spralastic, and summermulsion spredrite being 0·190, 0·235, 0·170, 0·085, and 0·070, respectively. In 1941 the highest index of 0·570 was again assigned to Bordeaux mixture 2–8–100, followed by cupro K 3–3–100 (0·345), Tenn. '26' 3–3–100 plus ½ lb. soy-bean flour (0·330), Tenn. '34' 2¼–3–100 (0·310), and copper hydro '40' 3–3–100 (0·305), the figures for the remaining nine fungicides ranging from 0·255 for Bordow 6–3–100 down to 0·085 for copper 'A' 1½–8–100. The control of leaf spot is expressed (for 1941 only, the differences in 1940 having been insignificant) as the percentage of leaves on 10th October with no infection on four tagged branches with 50 leaves per tag originally present. Bordeaux 2–8–100 received the highest rating of 64·7 per cent., followed by Bordow 6–3–100 (61·7) and Tenn. '34' 2¼–3–100 (54·2), the remaining

values ranging from 46·7 for Tenn. (dolomitic lime) down to 20·2 for cupro-K 3–3–100.

Very little correlation was found between control and retention of copper on cherry leaves in the orchard and on Pyralin plates in the laboratory or the tenacity index. There was, however, a significant correspondence between control and toxicity, expressed as LD50 [*R.A.M.*, xxii, p. 72], the maximum values for which in 1941 were assigned to Bordeaux 2–8–100 (0·150) and Bordow 6–3–100 (0·220). A significant correlation was further established between leaf spot control, tenacity index, and LD50.

From the results of these experiments it is concluded that laboratory methods of determining retention were reasonably accurate for the prediction of the same values in the orchard, but that toxicity to *C. hiemalis* was a much more important factor than retention in assessing the protective properties of the various fungicides.

BERTOLET (E.). **The finishing of Army ducks with special reference to mildew proofing.**—*Amer. Dyest. Reptr*, xxxii, 10, pp. P214–P219, 226, 1943.

Valuable information is presented concerning the treatment of United States Army duck fabrics with preservatives against mildew [*R.A.M.*, xxii, p. 479]. Recent studies at the Jeffersonville Quartermaster Depot, corroborated by an independent laboratory, showed that copper oleate, equivalent to 0·2 per cent. copper on the weight of the finished fabric, permitted a tensile strength loss of 45 per cent. on 14-day soil burial. No such loss occurred when the amount of copper was increased to 0·3 per cent., as was also the case in the treatment of sandbags in England [ibid., xxi, p. 214]. Basic copper carbonate and cuprous or cupric oxide with a 0·5 per cent. copper content failed to prevent the development of mildew during 14 days soil burial, whereas copper oleate at an equivalent concentration gave perfect control. When cuprammonium is used, a 1 to 1·5 or even 2 per cent. copper content is desirable. The alleged protective action of cutch browns is attributable to the 1 per cent. copper sulphate used for dyeing them.

Zinc dimethyl dithiocarbamate is considered to be the most promising of the alkyl derivatives. Zinc soaps are usually rated as having half the fungicidal efficiency of comparable copper preparations, while cadmium, for which a high degree of toxicity has been claimed, proved inferior to zinc.

The fungicidal action of silver on *Aspergillus niger* was demonstrated by growing the mould in a liquid medium in silver dishes, and further work on the possibilities of utilizing the metal as a mildew-repellant are in progress. Some fungi have been inhibited by a concentration of 12½ p.p.m. silver, while for others a dosage of 100 p.p.m. is requisite. In a number of tests, silver was rated as less toxic than mercury but more so than copper.

Phenyl mercury compounds are very powerful fungicides. An application of 0·5 per cent. phenyl-mercuro-2, 2′, 2″ nitrilotriethanol lactate, a quarternary addition product soluble in water in all proportions, is now being made on Army duck. A non-water-soluble compound, 9-phenylmercuro-, 10-acetoxy-, 12-octadecenoic acid, is available for use in solvent solution. Since August, 1942, orthophenylphenol has conferred satisfactory protection against mildew on the duck for jungle packs, while excellent results have also been obtained with 1 per cent. pentachlorophenol, which is likewise effective as a fire- and water-repellant. Large-scale trials are also in progress with dihydroxy-dichlor-diphenylmethane, while another compound under observation is 2, 2′ dihydroxy 5, 5′ dichloro-diphenyl methane. Pentachlorophenol is less liable than ortho-phenylphenol to be lost through volatilization in steam. The former compound tends to crystallize on the surface of the fabric, but this inconvenience may be obviated by passing the treated material over hot drying cans. The two-bath method of applying orthophenylphenol in conjunction with aluminium acetate has been found most effective,

leading as it does to the formation of the relatively insoluble aluminium ortho-phenylphenate. The mercury, silver, and lead salts of pentachlorophenol are the only pentachlorophenates less soluble in water than the original compound: they may be formed on the fibre by double decomposition with the sodium salt in a two-bath treatment. Pentachlorophenol, unlike ortho-phenylphenol and dihydroxy-dichlor-diphenylmethane, does not lower the hydrostatic resistance of duck.

VAN NIEL (C. B.). **Biochemistry of micro-organisms.**—*Ann. Rev. Biochem.*, xii, pp. 551–586, 1943.

Recent studies on the growth factors and metabolism of micro-organisms and on anti-bacterial agents [*R.A.M.*, xxii, p. 128] are summarized and critically discussed, the bibliography comprising 371 titles.

FAWNS (H. T.). **Food production by micro-organisms. Part II.**—*Food Manuf.*, xviii, 10, pp. 333–337, 1943.

This further instalment of the writer's survey of the available information on food production by micro-organisms [*R.A.M.*, xxii, p. 491] deals with the synthesis of fat by yeasts and moulds, including *Endomyces vernalis*, *Oospora lactis*, and *Penicillium* and *Aspergillus* spp. [ibid., xxii, p. 446].

THAYSEN (A. C.) & MORRIS (MURIEL). **Preparation of a giant strain of Torulopsis utilis.**—*Nature, Lond.*, clii, 3862, pp. 526–528, 1 fig., 1943.

Addition of camphor (30 mg. per 10 ml. wort agar) to cultures of *Torulopsis utilis* gave rise to a new strain of the fungus, designated *T. utilis* var. *major*, which showed increased size (average of 8·9 by 4·8 μ as against 7 by 3·8 μ in the standard strain) and volume (644 μ^3 as against 318 μ^3) of individual cells [cf. *R.A.M.*, xx, p. 548]. The new strain had also a shorter generation time under standard conditions of fermentation and possibly a higher phosphorus content of dry yeast than the standard. Tentative tests indicated that borneol and bornyl acetate, as well as camphene, are capable of inducing similar changes in this fungus, while colchicin and α-naphthylamine had no effect on cell size.

CASTAN (R.). **Recherches sur les conditions de tubérisation des stolons de Pomme de terre.** [Studies on the conditions of tuberization of Potato stolons.]—*C.R. Soc. Biol., Paris*, cxxxv, 7–8, pp. 578–580, 2 figs., 1941.

The studies of Costantin, Magrou, Bouget, *et al.* have demonstrated the favourable influence on potato tuberization of mountainous virgin soils containing the symbiotic fungi regarded as essential to the process [*R.A.M.*, xviii, p. 341]. In a series of tests at the University of Bordeaux, Up-to-Date seed was sown in soil from the Municipal Garden on 29th May, 1940, and the seedlings potted on 27th June in ordinary sifted soil mixed with sand. One lot of plants (C) was placed in a courtyard surrounded by walls 15 to 20 m. in height, another (A) on a balcony at an elevation of 10 m. above the courtyard, while a third (B) was transferred for 45 days preceding harvesting from the courtyard to the balcony. The amount of light registered on the balcony was almost 3½ times as much as that falling in the courtyard. The total numbers of tubers produced in series (A), (B), and (C) over periods of 120 to 140, 132, and 120 to 135 days, respectively, were 74, 19, and 4, respectively. The examination of the roots and rootlets failed to disclose the presence of symbiotic fungi, and it is therefore concluded that these organisms are not indispensable to tuberization, at any rate in the soils of low-lying regions. It is, however, obviously necessary to secure uniform conditions of illumination if conclusive experimental data are to be obtained.

MATTINGLEY (G. H.). **Seed Potato certification scheme. Objects and conditions.**—*J. Dep. Agric. Vict.*, xli, 9, pp. 433–436, 5 figs., 1943.

The seed potato certification scheme established in Victoria in 1938 [*R.A.M.*, xx, p. 77] provides for the examination of a sample of the seed stock from which the crop submitted for certification is being grown and two subsequent field inspections. At the first inspection, made approximately eight weeks after planting, only fields with less than 10 per cent. unhealthy plants are passed, the grower being requested to rogue all affected plants. The standard of purity at the second inspection, made three or four weeks later, is : virus diseases less than 2 per cent., other diseases less than 1 per cent., and rogues less than 1 per cent. Crops which satisfy these standards are approved subject to the normal potato inspection when the tubers are ready for dispatch.

The main virus diseases of potatoes in Victoria are stated to be mild mosaic [crinkle] (caused by viruses A and X), rugose mosaic (viruses X and Y), and leaf roll. The Carman group of varieties [ibid., xxii, p. 269] is very susceptible to both types of mosaic; Snowflake, Up-to-Date, and the American varieties Katahdin and Sebago are immune from crinkle; Snowflake is very resistant to rugose mosaic; and all commercial varieties grown in Victoria, but particularly Up-to-Date, are susceptible to leaf roll.

BLACK (W.) & COCKERHAM (G.). **Some modern aspects of Potato production.**—*Trans. Highl. agric. Soc. Scot.*, Fifth Ser., lv, pp. 37–53, 1943.

Up-to-date information on potato virus diseases, late blight [*Phytophthora infestans*], and other matters relating to the successful and efficient management of the potato crop in Scotland is presented in a popular form.

SALAMAN (R. N.). **Recent research in Potato breeding.**—*Emp. J. exp. Agric.*, xi, 43–44, pp. 125–139, 1943.

In this paper, the author discusses the influence that wart disease (*Synchytrium endobioticum*) has exercised on potato breeding, the effect of virus diseases in producing degeneration of potato varieties, the production of virus-resistant varieties, and the effects of recent Russian investigations on potato-breeding. The question of blight (*Phytophthora infestans*) resistance is touched on, and after reviewing future possibilities in the light of past experience the paper concludes with a table setting out (a) the characters required by breeders in potatoes to meet the physiological requirements of the plant, and (b) the sources (usually in wild species) found to be endowed with such qualities. A bibliography of 72 titles is appended.

BALD (J. G.). **Estimation of the leaf area of Potato plants for pathological studies.**—*Phytopathology*, xxxiii, 10, pp. 922–932, 2 graphs, 1943.

A method devised by N. C. Thirumalachary (*Indian J. agric. Sci.*, x, pp. 835–841, 1940) for the measurement of the leaf areas of experimental plants was found greatly to facilitate this normally laborious process. A series of standards is secured by making tracings of leaves graded in size from the smallest to the largest, the tracings are numbered serially, and each leaf on the test plants is matched with the standard nearest in size, the area of the leaf being recorded by the application to it of the number of the corresponding standard. In the author's modification and extension of this technique to the measurement of entire plants, the areas of all leaves on a few plants of varying size in a plot are compared with a set of standard leaves, the total area for each plant is referred to a scale covering the whole range of plant size, and the plants assigned numbers according to their

relative positions on the scale. They are then used as standards for computing the dimensions of all plants in the plots.

This very rapid and reasonably accurate method was applied to a block of 864 potato plants of two early (Early Carman and Western Australian Delaware), and two late (Up-to-Date and Tasmanian Brownell) varieties, arranged in 16 rows of 54, and forming part of an investigation on the transmission of leaf roll at the Division of Plant Industry, Canberra. The rates of increase in leaf area of the early and late varieties were similar until the former began to flower, after which they declined in comparison with those of the latter. Long-standing infection with leaf roll materially reduced the rate of increase in leaf area. Emergence continued over a longer period, and considerably under 100 per cent. of the seed tubers produced plants, the growth of which was slower and less regular than that of healthy ones of the same and other varieties. Many of the affected plants appeared to acquire a more vigorous habit during early November, reflected in the increase of leaf area between 31st October and 12th November. The initial slow growth was apparently due to the prevalence among the seed tubers of internal necrosis and thin sprouts, expressive of conditions very adverse to the translocation of nutrient substances and their application to the development of new tissues in the young plants.

SLEESMAN (J. P.) & WILSON (J. D.). **Comparison of fixed coppers and Bordeaux mixture in the control of insects and diseases on muck-grown Irish Cobbler Potatoes.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxviii, 223, pp. 173–183, 1943.

A tabulated account is given of experiments conducted on muck soil at McGuffy, Ohio, from 1934 to 1942, inclusive, to determine the comparative efficacy of Bordeaux mixture, fixed copper compounds, sulphur, and combinations of the two latter in the control of early and late blights (*Alternaria solani* and *Phytophthora infestans*) and the potato leafhopper and flea-beetle (*Empoasca fabae* and *Epitrix cucumeris*, respectively), on Irish Cobbler potatoes.

The resultant data show, *inter alia*, that modifications of the copper-lime ratio in the Bordeaux formula did not induce significant differences in leafhopper populations, disease control, or yield; that no appreciable benefit as regards insect control or yield accrued from the addition of calcium arsenate to Bordeaux mixture and a fixed copper dust; that the copper-lime dusts, copper oxychloride sulphate (COC-S), copper A compound, tribasic, and cuprocide Y, were comparable to Bordeaux mixture in insecticidal and fungicidal efficiency and stimulation of production, the oxychlorides giving superior leafhopper control and better yields than the basic sulphate or the oxide; and that the admixture of sulphur with fixed copper compounds was of doubtful value.

BONDE (R.), SCHULTZ (E. S.), & RALEIGH (W. P.). **Rate of spread and effect on yield of Potato virus diseases.**—*Bull. Me agric. Exp. Sta.* 421, 28 pp., 1943.

This bulletin contains the results of observations on the spread of potato virus diseases in Maine [*R.A.M.*, xxii, p. 222], and of studies of potato yields conducted on Long Island, New York, and in Aroostook County, Maine.

The spread of potato virus diseases in Maine during the 19-year period from 1924 to 1942 was found to vary from season to season: of mild mosaic [crinkle] from 4 to 97 per cent., leaf roll from 2 to 100 per cent., and spindle tuber from 1 to 61 per cent. The spread was most extensive in seasons most favourable to insect vectors common in Maine, namely *Myzus persicae*, *M. pseudosolani*, *Macrosiphum solanifolii*, and *Aphis abbreviata*, the first-named of which is believed to be, potentially at least, the most effective carrier of potato virus diseases studied.

Data for the five-year period, 1926 to 1930, showed that certification of seed

stock based on inspection in the field is unreliable, mainly owing to the masking of symptoms and late current-season infection, which easily escapes detection. On the other hand, advance testing of tuber samples of seed stock either in the greenhouse or in Florida gave a good index of the virus disease content.

The yields of Green Mountain and Bliss Triumph potatoes, when completely infected with leaf roll, spindle tuber, and the different types of mosaic, were significantly reduced, the reduction in 1928 ranging between 18 and 56 per cent. in Maine and between 26 and 64 per cent. on Long Island. The reductions in yield of Green Mountain due to crinkle, leaf-rolling mosaic and spindle tuber under Maine conditions amounted to 22, 27, and 18 per cent., respectively, and those due to crinkle mosaic, rugose mosaic, and leaf roll to 46, 50, and 45 per cent., respectively, whilst on Long Island spindle tuber reduced the yield 42 per cent. and leaf roll 53 per cent. Seed stocks with giant-hill abnormality, a late-maturing mutant of the Green Mountain variety, yielded slightly more than healthy ones in Maine and 26 per cent. less than healthy ones on Long Island. The early variety Bliss Triumph yielded more on Long Island than did Green Mountain, indicating that the conditions there in 1928 were more favourable for the earlier-maturing potatoes.

It thus appears that reductions in yield are not always directly proportionate to the amount of virus disease present, and are influenced by varietal and seasonal conditions, as well as by the location. In Maine in 1938 and 1939, leaf roll did not significantly reduce the yield in Irish Cobbler potatoes until 20 to 30 per cent. of the plants were infected, whereas in the Green Mountain variety a significant yield reduction was caused by a 12 per cent. infection; in 1939, less than 30 per cent. mild mosaic produced no significant reduction in yield, while 12 per cent. rugose mosaic caused one in the Green Mountain variety.

The more extensive spread of leaf roll in Maine since 1937 is attributed in part to the fact that improved cultural practices have protracted the growing period of the potato crop, thus allowing a longer time for the aphids to feed and to disseminate the virus, as well as for the virus to pass from leaves through stems to tubers.

Although the results of these studies have shown that the presence of relatively low percentages of virus diseases in seed potatoes may not materially reduce the yield, experience, on the other hand, has shown that when insect vectors are numerous, seed stocks with from 1 to 5 per cent. mosaic or leaf roll may produce 50 or 100 per cent. diseased plants in the following year. The importance of maintaining rigid control of virus diseases and of the production of disease-free seed potatoes is, therefore, again emphasized.

Virus diseases of Potatoes. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liv, 8, pp. 358–362, 5 figs., 1943.

Of the virus diseases stated to attack potatoes in New South Wales [*R.A.M.*, xxii, p. 173], leaf roll is the most important in the widely-grown variety Factor, and may reduce the yield by one-half or more. Mosaic [including potato virus X], which may cause serious losses in other varieties, occurs as rugose, mild, aucuba, or other types, varying considerably in their effect on yield. Witches' broom causes the production of a large number of tubers, none or only few of which are of marketable size. Bronze wilt [caused by the tomato spotted wilt virus: ibid., xxii, p. 369] may be of importance near large towns. The chief means of controlling virus diseases is the selection of healthy seed, which should be carried out in the field, where foliage can serve as indicator. In tableland districts suitable for seed-growing, recommendations consist in maintaining stud seed plots, culling-out of weak-shooted tubers before planting, and roguing infected plants as early in the season as possible.

SMALL (T.). **Black scurf and stem canker of Potato (Corticium solani Bourd. & Galz.). Field studies on the use of clean and contaminated seed Potatoes and on the contamination of crop tubers.**—*Ann. appl. Biol.*, xxx, 3, pp. 221–226, 1943.

The results of field trials conducted on infected soil at Warburton, Cheshire, in 1941 and 1942 showed that black scurf and stem canker (*Corticium solani*) [*R.A.M.*, xxi, p. 591] developed on potato crops grown from clean, as well as from contaminated seed, but that it was more severe on the latter. Seed treatment with a proprietary organo-mercury preparation gave little, if any, control. The yields from clean-seed plots were no greater than those from the contaminated, and there was no relation between the yield and the amount of black scurf on the tubers in any of the trials. In one 1942 trial stem canker was present on 209 of the growing shoots on 78 of 100 plants from contaminated seed, the number of healthy shoots being 289, and on only 41 shoots on 19 of 100 plants from clean seed, there being 423 healthy shoots. Young tubers were present on 95 plants from the clean-seed plots, the total being 691, and on only 49 plants from the contaminated-seed plots, with a total of 132; there were 19 diseased stolons on the former and 36 on the latter plots. These results are taken to indicate that despite favourable conditions for the disease and the prevalence of *C. solani* in the soil, the attack on the young shoots and the check to tuber formation were caused mainly by the fungus on the seed tubers and not by that in the soil. It is assumed that plants raised from contaminated seed are severely attacked early in the season, but recover almost completely later on.

More black scurf occurred on late-dug than on early-dug crops in 1941, while in 1942 the attack was earlier and more severe, and even the earliest dug crop was heavily contaminated. Inoculation of seed at planting time did not affect the results. Misses and wilted shoots were rare in all trials; and in most cases fresh shoots were growing from the dead primary shoot or directly from the tuber. The amount of black scurf was only very little reduced by late planting, nor were the yields affected. All potato varieties tested, namely Arran Banner, Kerr's Pink, King Edward, and Majestic, were heavily infected but recovered well from probable early attacks on the young shoots. It is concluded that *C. solani* in the soil or on the seed causes little, if any, loss under ordinary farm conditions in this country.

WALLACE (T.) & WAIN (R. L.). **The blackening of cooked Potatoes.**—*J. Minist. Agric.*, l, 9, pp. 425–428, 1943.

It was demonstrated in a field experiment carried out in 1942 at Long Ashton that blackening of cooked potatoes [*R.A.M.*, xxii, p. 105] may result from deficiency of potassium (accentuated by high nitrogen) or of phosphorus. A sand culture experiment confirmed the effect of the latter deficiency and showed that the blackening was associated with the highest content of iron in the tubers. A discoloration was also caused by calcium deficiency, but is considered to be distinct from the typical blackening noted in the above two cases. It is suggested that the accumulation of iron may occur in different ways in the cases of potassium and phosphorus deficiencies. With the former there is no evidence that the intake of iron by the plant is increased, but iron tends to become immobile owing to excessive oxidation and to accumulate at points such as nodes; with the latter, on the other hand, an increased absorption of iron and its increased mobility in the plant may occur, as phosphate acts as a precipitant. The fact that blackening did not result from potassium deficiency in the sand culture is taken to indicate that the problem is complicated.

SCHULTZ (E. P.). **Las proximas siembras del Arroz con especial referencia a la enfermedad de la 'brusone' ('Piricularia oryzae').** [The next Rice sowings, with special reference to the 'blast' disease (*Piricularia oryzae*).]—*Circ. Estac. exp. agríc. Tucumán* 118, 3 pp., 1943.

Since the first observation of rice blast (*Piricularia oryzae*) in Tucumán, Argentina [*R.A.M.*, xiv, p. 529], the disease has reappeared at intervals, mostly in a sporadic form and during periods of scanty rainfall. The first symptoms—discoloration of the upper parts of the shoots and drooping of the tips of the ears—generally appear about the middle or end of March, but in 1943 the yellow or chestnut lesions of the fungus developed at the beginning of February in the Río Chico plantations, and between the end of the month and mid-March infection spread extensively throughout the south, especially among the debilitated dry-land crops. In the Santa Catalina district, where the pathogen assumed an exceptionally virulent form, its spores were conveyed by the wind to a planting of Blue Rose under irrigation, 40 m. away, in an otherwise perfect state of health and development, the severity of infection gradually declining with distance from the focus until complete freedom was reached at 80 m.

In experiments to determine the transmissibility of *P. oryzae* by means of the seed, plots of Giant Japanese, Lady Wright, and Late Caloro, raised from seed from diseased plantations, contracted heavy infection, resulting in a yield reduction of 50 to 60 per cent., which did not, however, spread to the surrounding Blue Rose crops. Since the pathogen overwinters in the soil and during the summer attacks at least one wild grass, *Panicum sanguinale* [ibid., xx, p. 423], it may develop even where due precautions are taken for its exclusion, notably through the use of seed from perfectly sound plantings. As a result of the severe epidemic of blast in 1943, there is likely to be a shortage of healthy dry-land seed, and plantings of this type of rice should therefore be separated by at least 100 to 200 m. from crops grown under irrigation, the intervening space being preferably occupied by a field of maize, sorghum, sunflower, soy-bean, or the like. The purchase of foreign varieties of aquatic rice is very inadvisable, since they are frequently unsuited to local conditions, and may introduce new diseases into the country. The possibilities of combating *P. oryzae* by means of seed disinfection require further testing.

NIEDERHAUSER (J. S.). **A bacterial leaf spot and blight of the Russian Dandelion.**—*Phytopathology*, xxxiii, 10, pp. 959–961, 1943.

A full description is given of *Xanthomonas taraxaci* n.sp., the agent of a severe leaf spot and blight of *Taraxacum kok-saghyz* affecting 15 per cent. of the plants in a test plot at Ithaca, New York, during cloudy, wet weather in September to mid-October, 1942. The black, yellow-bordered lesions range in size from minute dots to necrotic areas covering almost the entire lamina. Ordinarily the outer leaves are most severely attacked. The rod-shaped, motile, uniflagellate, Gram-negative bacterium isolated from the infected tissues occurs singly or in pairs and measures (at 24 hours on potato dextrose agar at 27° C.) 1·4 to 3·3 by 0·7 to 1·2 (average 2·3 by 0·9) μ. Growth is moderate on beef extract-peptone agar and abundant on potato dextrose agar, the colonies on the former medium being circular, smooth, and bright yellow and on the latter pale yellow, mucoid, and glistening. *X. taraxaci* grows well in milk, reducing litmus and precipitating and slowly digesting a soft casein curd, tyrosine crystals being extensively produced in the supernatant liquid. The minimum, optimum, and maximum temperatures for growth are 0° to 3°, 30°, and 38° C., respectively. The organism develops well in gelatine and in tryptophane broth, rapidly liquefying the former and evolving hydrogen sulphide, but not indol, from the latter. Nitrate and ammonium salts can be utilized as a source of nitrogen; nitrates are not reduced to nitrites; lipase is formed. Acid is produced from xylose, dextrose, galactose, levulose, lactose,

sucrose, and glycerol; the salts of acetic, citric, lactic, malic, and succinic acids are utilized with an increase in the hydrogen-ion concentration; and starch is hydrolysed. The sodium chloride tolerance of the pathogen lies between 3·25 and 5 per cent.

Positive results were obtained in inoculation experiments on both wounded and uninjured leaves, the lesions being typical of those in the field, and the organism was consistently reisolated in pure culture.

PRESLEY (J. T.). **Some diseases affecting cultivated Guayule in the Southwest during 1942.**—*Plant Dis. Reptr*, xxvii, 3–4, pp. 94–96, 1943. [Mimeographed.]

Short, popular notes are given on diseases affecting cultivated guayule [*Parthenium argentatum*] in the nursery and field. Nursery seedlings are affected by damping-off, associated with species of *Pythium*, *Rhizoctonia*, and *Fusarium*, wilt (*Verticillium albo-atrum*), crown rot (where excessive watering is practised) due to the water-moulds *Pythium* and *Phytophthora*, cottony rot (*Sclerotinia sclerotiorum*), and *Botrytis* rot, caused by the *Botrytis* stage of a species of *Sclerotinia*. Diseases observed in the field include *Sclerotinia* rot, *Verticillium* wilt, crown rot apparently due to *Pythium* and *Phytophthora*, and Texas root rot (*Phymatotrichum omnivorum*) [*R.A.M.*, xxii, p. 496]. Inoculation experiments demonstrated that *Sclerotium rolfsii* is able to attack and destroy guayule plants, and must be considered a potential menace to field plantings.

MARSH (A. W.) & BOLLEN (W. B.). **Effect of manganese on the microflora and respiration of some Oregon soils.**—*J. Amer. Soc. Agron.*, xxxv, 10, pp. 895–900, 1 graph, 1943.

Manganese sulphate added to several Oregon soils at rates equivalent to 40 and 100 lb. per acre increased the [unspecified] mould count in Willamette silty clay loam and Braillier peat by about 100 per cent., and the bacterial population in the latter by 160 per cent. The same treatment produced a 50 per cent. decrease in the mould count in Newberg loamy sand.

The microbial production of carbon dioxide was increased by manganese sulphate (100 lb. per acre) in the Klamath peat and Newberg soils, but in Chehalis silty loam the compound apparently exerted no effect. The response was in roughly inverse proportion to available manganese.

POHLMAN (G. G.) & NOTTINGHAM (R. J.). **Numbers of micro-organisms in relation to aggregate size.**—*Iowa St. Coll. J. Sci.*, xv, 4, pp. 447–450, 1941.

An examination of soil aggregates of various sizes revealed no significant differences in the numbers of fungi and bacteria, variations within triplicate plates from the same aggregate being in most cases greater than between those from different ones. Nor could the numbers of Actinomycetes on the bacterial plates be correlated with size of aggregates. It is considered that the results of this preliminary study lend support to the conclusions of Myers and McCalla (*Soil Sci.*, 51, pp. 189–200, 1941) that the effect of micro-organisms in stabilizing soil aggregates [*R.A.M.*, xxi, p. 221] is due to their products rather than to the organisms themselves.

BRENCHLEY (WINIFRED E.). **Minor elements and plant growth.**—*Biol. Rev.*, xviii, 4, pp. 159–171, 1943.

Following an introductory note on the relation of 'trace' elements to plant growth, the available information on the subject is critically reviewed under the headings of boron, copper, iodine, manganese, molybdenum, selenium, zinc, and other elements, viz., arsenic, barium, chromium, cobalt, lead, lithium, nickel,

rubidium, strontium, thallium, and vanadium. A three-page bibliography is appended.

Arnon (D. I.). **Mineral nutrition of plants.**—*Ann. Rev. Biochem.*, xii, pp. 493–528, 1943.

Included in this critical survey of recent contributions to the study of the mineral nutrition of plants are a number of references to work dealing with this factor in relation to plant diseases.

Miller (J. H.). **The starting point for nomenclature of the fungi.**—*Mycologia*, xxxv, 5, pp. 584–589, 1943.

The author discusses the divergence of opinion regarding the interpretation of Article 19, f, of the International Rules of Botanical Nomenclature which states that Fries, *Systema Mycologicum*, 1821–1832, is the starting-point for the nomenclature of all fungi except Uredinales, Ustilaginales, and Gasteromycetes. He considers that the logical procedure is to accept the name recognized by Fries in the *Systema* and stresses the confusion that would arise if the starting date were altered to 1821. Other subjects discussed are the method of citing the authority for the specific name and the choice of specific names used in the *Systema*.

Brien (R. M.). **First supplement to 'A list of plant diseases recorded in New Zealand'.**—*N.Z. J. Sci. Tech.*, A, xxiv, 1, pp. 62–64, 1942.

This first supplement to the author's list of New Zealand plant diseases [*R.A.M.*, xviii, p. 726], comprising 35 maladies of fungal, bacterial, virus, and physiological origin on 36 hosts, contains the following new records: *Verticillium dahliae* on *Acer palmatum*, *Rhynchosporium secalis* on *Agropyron repens* and *Hordeum murinum*, tobacco mosaic virus on chilli, *Elsinoe fawcetti* on lime (*Citrus aurantiifolia*), *Botrytis cinerea* on *Euphorbia peplus* and *Fragaria* sp. (cultivated), *Marssonina panattoniana* on lettuce, *Pythium de Baryanum* and *V. dahliae* on tomato, *Stagonospora curtisii* on cultivated *Narcissus*, *Sphacelotheca panici-leucophaei* on *Panicum miliaceum*, *Sclerotinia sclerotiorum* on *Petunia* sp., and *Phytomonas* [*Bacterium*] *tumefaciens* on rhubarb and loganberry.

Hansford (C. G.). **Host list of the parasitic fungi of Uganda. Parts I, II, and III.**—*E. Afr. Agric. J.*, viii, 4, pp. 248–252; ix, 1, pp. 50–55; 2, pp. 102–106, 1943.

The author has revised his original host list of the parasitic fungi of Uganda [*R.A.M.*, xvii, p. 345] in the light of recent research and incorporated in the present contribution a considerable number of new records [ibid., xx, pp. 596, 597].

Kern (F. D.). **The importance of taxonomic studies of the fungi.**—*Torreya*, xliii, 1, pp. 65–77, 1943.

In this paper, read at the 75th Anniversary Celebration of the Torrey Botanical Club at the New York Botanical Garden, 23rd June, 1942, the author gives an historical survey of taxonomic studies of the fungi and discusses some of the contemporary aspects of nomenclature.

Virus names used in the Review of Applied Mycology.—44 pp., Imperial Mycological Institute, 1944. [Mimeographed.]

This *Review* has consistently refrained from adopting any system for the 'scientific' nomenclature of viruses since no system yet invented has obtained international acceptance. In the past a virus has been indexed either under the English common name of the disease it causes or under some other widely used designation.

The common names for many diseases are accepted throughout the English-

speaking world, they are frequently without ambiguity, and they will presumably continue to be used after the viruses have received internationally acceptable scientific names. It has been decided, therefore, to index viruses in this *Review*, with one or two exceptions, under names derived from the English common names of the diseases they cause, i.e., tobacco mosaic virus, cranberry false blossom virus. To this end an effort is being made to standardize disease names and after consultation with a number of virus workers and official plant pathologists this tentative list of disease names and of the virus names of the causal viruses accepted in the *Review* together with many of their synonyms has been compiled.

It is intended eventually to issue a revised version in printed form.

[A limited number of copies of this mimeographed list are available at the price of 1*s*. 0*d*. post free.]

FULLING (E. H.). **Plant life and the law of man IV. Barberry, Currant and Gooseberry, and Cedar control.**—*Bot. Rev.*, ix, 8, pp. 483–592, 2 maps, 1943.

The author has assembled a quantity of useful information relating to legislation for the eradication and quarantine of alternate hosts as a means of combating three heteroecious fungal diseases, namely, black stem rust of wheat and other cereals (*Puccinia graminis*), white pine blister rust (*Cronartium ribicola*), and cedar-apple rust (*Gymnosporangium juniperi-virginianae*) with special reference to the United States. The section concerning each disease is furnished with a separate bibliography.

St. Lucia. Plant Protection Ordinance. No. 12 of 1942.—*Govt Gaz.*, pp. 31–40, 1942.

This Ordinance empowers the Governor in Council to make regulations providing for the prevention, eradication, and control of diseases and pests affecting plants, and supersedes Ordinance No. 30 of 1939.

Service and regulatory announcements April–June, 1943. Importation of plants and plant products by mail.—*S.R.A.*, *B.E.P.Q.*, *U.S. Dep. Agric.*, pp. 21–22, 1943.

To assist in the enforcement of the various orders, quarantines, and regulations prohibiting or limiting the entry into the United States by mail of certain plants or plant products, provisions have been made (30th June, 1943) by the Bureau of Entomology and Plant Quarantine of the Department of Agriculture, concurrently with the Postal and Customs Services, and are here cited, to insure the closer inspection of such importations.

Distribution maps of plant diseases.—Maps 25–48. Issued by the Imperial Mycological Institute, 1943. 3*s*. 9*d*.

The second year's issue of this series of maps showing the world distribution of major crop diseases [*R.A.M.*, xxii, p. 48] comprises (No. 25) cotton leaf curl virus, (26) *Corynebacterium michiganense* on tomato, (27) *Dothidella ulei* on *Hevea* rubber, (28) *Peronospora schachtii* on beet, (29) sugar-cane chlorotic streak, (30) *Stereum purpureum* on plum, apple, hardwoods, etc., (31) *Fusarium oxysporum* var. *cubense* on banana, (32) *F. lini* on flax, (33) *Xanthomonas albilineans* on sugar-cane, (34) *Spongospora subterranea* on potato, (35) *Phytophthora citrophthora* on citrus, (36) *Ceratostomella ulmi* on elm, (37) *Marasmius perniciosus* on cacao, (38) *Nectria galligena* on apple, (39) *X. rubrilineans* on sugar-cane, (40) *Puccinia antirrhini* on *Antirrhinum*, (41) *X. stewarti* on maize, (42) *Phaeocryptopus gaeumanni* on *Pseudotsuga taxifolia*, (43) rice dwarf disease, (44) *Sclerotinia laxa* on fruit, (45) *Exobasidium vexans* on tea, (46) onion yellow dwarf, (47) *Phytophthora hibernalis* on citrus, and (48) *Dibotryon morbosum* on plum and other *Prunus* spp.

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LINDER (D. H.). **New species of Sphaeropsidales and Melanconiales.**—*Mycologia*, xxxv, 5, pp. 495–502, 1 fig., 1943.

Descriptions are given of five new species of Sphaeropsidales and Melanconiales, including *Dothiorella pinastri*, *Cryptosporium pinicola*, and *C. lunasporum*, all three on living blister rust cankers of *Pinus monticola* in Idaho. A key is presented illustrating the differences between the species of *C.* occurring on conifers in North America. This genus is difficult to define. In the early stages of development certain of the species might be placed in the Sphaeropsidales because of the formation of pycnidia, which, however, later rupture to form acervuli with free margins. Such acervuli are also characteristic of the Excipulaceae, yet the genus is placed in the Melanconiaceae. In this family are the genera *Hainesia*, *Gloeosporium*, and *Cryptosporium*, between which there appears to be no clear line of demarcation. *C. acicolum*, occurring as it does on leaves, might be placed in *Hainesia* or *Cercospora*. If this species is excluded, the essential characters of *Cryptosporium* appear to be the large, falcate conidia, the erumpent acervuli, which, as already mentioned, subsequently rupture, and the predominant occurrence on bark and twigs.

BITANCOURT (A. A.) & JENKINS (ANNA E.). **Elsinoe viticola.**—*Mycologia*, xxxv, 5, pp. 510–516, 1 fig., 1943.

Arnaud, in his survey of the Myriangiales, examined herbarium material of *Elsinoe viticola* on *Vitis coriacea* from Buitenzorg, Java (a species described by Raciborski in 1900), but his search for asci was unsuccessful.

In 1938 the authors undertook a critical study of Raciborski's exsiccatum of *E. viticola*. Sections of the most prominent fruiting bodies proved to belong to old pycnidia of a *Phyllosticta*, not necessarily connected genetically with the *Elsinoe*. Certain brown areas appeared to indicate where asci of the *Elsinoe* were produced. None were observed in these parts, but there was an abundance of hyphae typical of the genus, and therefore undoubtedly belonging to *E. viticola*. It remains a fact, therefore, that asci of this species have been seen, so far as is known, only by Raciborski.

The other species of *E.* known on Vitaceae is *E. ampelina*, the cause of vine anthracnose. The perfect stage of this species has been found only once, and there has been conjecture as to whether this fungus was not the same as *E. viticola* [*R.A.M.*, ix, p. 65; xiv, p. 616]. Lesions on *Vitis* produced by *E. ampelina* are, however, quite distinct from those on *Tetrastigma* (to which the type host of *E. viticola* is now referred), and as species of *Elsinoe* are often specific in their host relations, the previous reason for considering the vine anthracnose organism as identical, or possibly identical, with *E. viticola* no longer holds. *E. viticola* is considered to stand without synonymy, as originally described.

RISCHKOV [RYJKOFF] (V. L.). **The nature of ultra-viruses and their biological activity.**—*Phytopathology*, xxxiii, 10, pp. 950–954, 1943.

In the author's studies at the Institute of Microbiology, Academy of Sciences of

the U.S.S.R., Moscow, the nitrogen, phosphorus, and carbohydrate contents of healthy and mosaic-diseased tobacco plants were determined with the object of providing data regarding the nature of plant viruses. The results of an analysis of the nitrogen metabolism failed to show what is taken from the plant by the virus, but under conditions of phosphorus and nitrogen starvation diseased plants lost less protein than the healthy. The phosphorus content in diseased plants was no more, and often less, than that of the healthy. The amount of phosphorus in soluble proteins increased in the diseased plants, whilst that in the insoluble structural protein decreased, so that an expenditure of structural nucleoproteids appears to take place. Data are presented to show that the accumulation of virus is accompanied by a diminution of carbohydrates. From experiments on the physiological conditions necessary for the accumulation of virus in tobacco leaves it was found that there is no accumulation at 5° C. and that the accumulation is more rapid at 20° than at 15°.

WELLMAN (F. L.). **A new species of Fusarium causing vascular wilt of Tomato.**—*Phytopathology*, xxxiii, 10, pp. 956–958, 2 figs., 1943.

A technical description is given of a new species of *Fusarium* originating on a tomato showing symptoms indistinguishable from those caused by *F. bulbigenum* var. *lycopersici* in Indiana [*R.A.M.*, xx, p. 91], which also developed on Bonny Best and Marglobe inoculated with the new fungus. *F. retusum* n.sp. forms on potato dextrose agar a somewhat coarse, loose, fluffy, rapidly growing mat ranging in colour from white through livid pink, various shades of yellow, orange, tawny-olive, and garnet-brown to Morocco red; white, later greenish sclerotia developed sparsely, while cream-coloured sporodochia appeared consistently in a few monosporous isolates only. Infection hyphae were detected in re-isolation and histological studies exclusively in the xylem elements of diseased stems. The hyaline or faintly yellow- or red-tinted, septate, branched hyphae range from 2 to 7·5 μ in diameter; the hyaline, profusely branched sporophores bear colourless, straight to slightly curved, uni- to quinque-, mostly triseptate macroconidia, with a rounded, blunt apex and a distinct 'foot' on the proximal end, 26·8 by 4·3 μ; and hyaline, mostly unicellular, rarely uniseptate microconidia, generally oblong and umbonate at the base, 9·9 by 3·8 μ; the colourless, densely granular chlamydospores, of variable size and shape, occur principally in intercalary positions in the mycelium or in macroconidia. Morphologically the species is widely divergent from the slower growing *F. bulbigenum* var. *lycopersici* and possibly approaches *F. poae*, from which it differs in its blunt and rounded distal ends of the macrospores.

WILSON (J. D.). **Tomato varieties and the timing of spray schedules.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxviii, 221, pp. 75–82, 6 graphs, 1943.

A full account is given of an investigation in 1942 of the connexion between spray schedule timing and the control of fungal defoliation, ordinarily caused by early blight [*Alternaria solani*] and leaf spot [*Septoria lycopersici*: *R.A.M.*, xxii, p. 157], but during the very dry period covered by the tests at Wooster, Ohio, the latter disease was absent and the former developed abnormally late. Five varieties with different ripening dates were selected, namely, Huelsen (early), Stokesdale (medium-early), J.T.D. and Baltimore (medium), and Rutgers (late), and a fixed copper spray (COC-S) [copper oxychloride sulphate] applied in four schedules of five applications each, commencing on 20th June and 2nd, 14th, and 26th July, respectively.

The infection index of the several varieties was determined at weekly intervals from 2nd August to 20th September by Horsfall and Heuberger's method [ibid., xxi, p. 354]. Huelsen showed the highest incidence of disease throughout the season and Rutgers the lowest. The untreated plots of all varieties deteriorated

rapidly after 30th August. The average health of all the varieties was best in the plots sprayed from 2nd July onwards. The sprayed plots yielded an average of 10 per cent. more first-grade fruits than the controls, Rutgers being the heaviest producer of superior tomatoes, and Huelsen and J.T.D. the poorest. Maturity was appreciably retarded by spraying, especially in the plots to which the earliest schedule was applied. Early treatments also tended to increase the amount of blossom-end rot, particularly in the most susceptible J.T.D. variety, while the two latest schedules improved the condition of the plants in this respect.

CRANDALL (B. S.). **Bacterial infection and decay of the inner wood of winter-injured young London Plane trees.**—*Phytopathology*, xxxiii, 10, pp. 963–964, 1943.

In 1934 five-year-old London plane (*Platanus acerifolia*) trees on bottom land in a Maryland nursery were found to be infected by *Polystictus versicolor* and a Gram-negative, rod-shaped bacterium, 0·25 by 0·5 μ; the latter was experimentally shown to be pathogenic to the shoots of newly rooted cuttings. The trees had been injured by severe weather in March, 1932, and again in February, 1934, when frost cracks developing on the bark covering the water-soaked, necrotic inner wood served as channels of entry for the decay-producing organisms. Pruning wounds also acted as sites of ingress for *P. versicolor*, which rotted the inner ring tissues up to 6 in. in each direction from the cut.

WATERMAN (ALMA M.). **Diplodia pinea and Sphaeropsis malorum on soft Pines.**—*Phytopathology*, xxxiii, 9, pp. 828–831, 1943.

Examination of the type specimen of *Diplodia pinea* var. *corticola* Peck showed the spores to be smaller than those of *D. pinea* and within the range of *Sphaeropsis malorum* (*Physalospora obtusa*) to which species it was referred by Stevens [*R.A.M.*, xiii, p. 312]. A species resembling *S. malorum* (*P. obtusa*) has been found on dead areas on branches or trunks of *Pinus strobus* and certain old records of the fungus on *Pinus* are cited.

The results of field observations and inoculation experiments indicate, however, that neither *D. pinea* nor *S. malorum* is parasitic on the leaves and twigs of the new growth of young, vigorous white pines in New England [ibid., xvi, p. 75; xxii, p. 412], although both fungi may contribute to the unhealthy condition of soft pines weakened in the first instance by other factors. In a series of tests with *P. obtusa* on *Pinus nigra*, *P. sylvestris*, *P. strobus*, and *P. resinosa*, only one infection developed on a wounded twig of *P. sylvestris*. Improved cultural conditions and the prevention or protection of injuries should materially reduce the likelihood of invasion by the two organisms in question.

HUBERMAN (M. A.). **Sunscald of Eastern White Pine, Pinus strobus L.**—*Ecology*, xxiv, 4, pp. 456–471, 3 figs., 1 diag., 15 graphs, 1943.

Injury to the bark on the sun-exposed south-western sides of eastern white pines (*Pinus strobus*) standing on the north and east edges of openings made in forest stands is frequently observed throughout New England and elsewhere. It occurs on dark-coloured, smooth-barked trees in the form of dead strips of bark which often peel off, exposing the sapwood, or merely appear as depressed discoloured areas. The injury seriously degrades logs cut from the affected part, and provides entrance to fungi and insects. The injury measures on an average 6 to 29 ft. in length and 3·3 to 7·3 in. in width at its widest part, and affects most commonly trees with a diameter of 4 to 10 in., 31 to 51 years of age, in the intermediate crown class, and with a bark 3·7 to 7·5 mm. thick. Topography of the site does not materially influence the occurrence of the injury. Microscopic examination of the injured tissue indicated that the injury occurred after summer wood formation

had stopped and before spring wood formation had started, that is, between 1st October and 1st April. The highest summer temperature recorded (43° C.) was 14° below that supposed to be lethal to the tree, and was maintained for too short a time to have had any effect. Most frequently repeated thawing and freezing is encountered on the south side, and the most abrupt temperature drop is on the south-west side in winter. Sunscald in the north-east is considered to be a winter injury, and it is concluded both from the available literature and from evidence collected in this study that rapid freezing is a possible cause. Sunscald injury can be avoided by making the smallest possible openings consistent with sound silviculture; 'screen' trees should be left uncut on the southern and western borders of woodlots; extensive clear-cutting should not be used; and pruning of young trees should be done in two or more steps.

ARNOLD (W. P.). **Chemically treated wood in war and industry.**—*Chem. Engng News*, xxi, 14, pp. 1168–1171, 4 figs., 1943.

This is a useful survey of the different methods of chemical treatment of wood against various pathogenic agencies, including fungi, and of the standard preservatives in current use in the United States, with special emphasis on war-time conditions.

CARTWRIGHT (R. ST.-G.) & FINDLAY (W. P. K.). **Timber decay.**—*Biol. Rev.*, xviii, 4, pp. 145–158, 1943.

A brief historical introduction to the subject of timber decay is followed by a critical survey and discussion of important contributions to the understanding of the problems involved under the headings of silvicultural considerations; diagnosis of cause of wood rots by pure cultural methods; general descriptive work; physiology of wood-rotting fungi; physical effects of decay in wood; chemical effects of decay in wood; effect of fungal decay on microscopic structure of wood; natural durability and resistance to decay of timbers; preservation of timber by chemical treatment; and field studies of timber decay and the application of the results of research to practice.

SCHMIDT (HERTA). **Die Samenbeizung, ein Weg zur Leistungssteigerung im Gemüsebau.** [Seed disinfection, a means of increasing production in vegetable crops.]—*Kranke Pflanze*, xx, 3–4, pp. 19–22, 1943.

In connexion with war-time demands for increased vegetable production in Germany the writer discusses some important aspects of seed treatment, one of the foremost means towards this end. Only preparations officially sanctioned by the Biological Institute should be used, comprising at the moment abavit, ceresan, fusariol, and germisan, a liquid and dry form of each; formaldehyde is also permitted but can be dispensed with for horticultural purposes. Dusts are more suitable for some types of seed, such as flax, stocks, and snapdragon [*Antirrhinum majus*], which tend to become slimy on wetting, and liquid preparations for others, including lettuce, beans, peas, and *Lathyrus*. Tomato seeds are sensitive to chemical injury, and should either be dusted or immersed for brief periods (not exceeding 15 minutes) in a disinfectant solution.

LING (L.) & YANG (JUHWA Y.). **Rape mosaic.**—*Nanking J.*, ix, pp. 293–304, 1 fig., [? 1940. Chinese, with English summary.]

In addition to information already summarized from another source [*R.A.M.*, xix, p. 514], it is stated in this paper that over 30 per cent. of the Chinese rape crop has been known to be destroyed by mosaic, while the survivors were stunted. The reduction in the seed yield ranged from 37 to 85·6 per cent. in the samples examined, while the crude oil content also declined substantially.

Björling (K.). **Några betningsförsök mot brunbakterios.** [Some disinfection tests against brown bacteriosis.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vii, 5, pp. 7–11, 1943.

Dusting with uspulun (2 gm. per kg.) gave the best control of *Pseudomonas* [*Xanthomonas*] *campestris* on swedes in a series of experiments in Sweden, where the losses from this source may amount to 50 per cent. of the crop. In the latest test in 1942–3, for instance, involving 720 plants, the percentages of infection in the control, 0·1 per cent. formalin-treated, and uspulun-dusted lots were 74·2±3·42, 41·3±3·65, and 30·8±3·58, respectively, and the corresponding yields 19·1±0·95, 21·7±0·74, and 23·4±0·53, respectively.

Brickley (W. D.). **The efficiency of spray treatment as a remedy for boron deficiency in Sugar Beet and Swedes and for manganese deficiency in Oats.**—*J. Dep. Agric. Éire*, xl, 1, pp. 144–148, 1943.

Brown heart [*R.A.M.*, xx, p. 616; xxi, p. 426] having affected about 90 per cent. of the swedes on an alkaline light soil at Kilberry, South County Kildare, in 1940, a test was carried out in 1941 on another portion of the field, borax being applied (*a*) by broadcasting at the rate of 21 lb. per acre at sowing time, (*b*) at the side of the bulbs on 23rd July at the same rate, and (*c*) by spraying on the latter date with 7½ lb. borax per acre (i.e., 1 lb. per 10 gals. water), one plot remaining untreated. At harvest the bulbs showed, respectively, 22, 19, 17, and 66 per cent. brown heart.

In August, 1942, treatment of sugar beets severely affected by crown rot with borax applied to the soil at the rate of 20 lb. per acre, or as a spray at the rate of 5 lb. per acre (1 lb. per 20 gals. water) resulted in yields of 8 tons, 11 cwt., and 8 tons, 8 cwt. roots per acre, respectively, compared with 6 tons, 10 cwt. for the control areas.

When oats in areas (*a*) moderately, (*b*) very severely, affected by grey speck (manganese deficiency) [ibid., xxi, p. 522] were sprayed with manganese sulphate (1 per cent. solution, 10 lb. per acre), the treated plots showed improvement in six days and were comparatively healthy two weeks after treatment, the new growth produced after treatment being clean. Severe symptoms developed in the controls. The yields of grain and straw per perch were, in the severely diseased area, 1·7 and 7·5 lb. for the unsprayed plants, as against 8·75 and 19·25 lb. for the sprayed.

Carsner (E.) & Bennett (C. W.). **Name and classification of the curly-top virus.**—*Science*, N.S., xcviii, 2548, pp. 385–386, 1943.

The authors advance the view that the placing by Holmes of the curly-top virus in the family Chlorogenaceae and the genus *Chlorogenus* is erroneous, and that according to the symptoms induced by this virus in beets and other hosts it should be transferred to the family Rugaceae and the genus *Ruga*. The specific epithet, *eutetticola*, is also contested as being based on the assumption that the virus has only one vector, *Eutettix tenellus*, whereas it is now known that it is transmitted by *Agalliana ensigera* in Argentina; it is furthermore considered to be orthographically incorrect, the proper root for the first member being *eutettig-*. In view of the symptoms typical of the virus and because of its vector relationships it is proposed to adopt for it the name *Ruga verrucosans*, the specific epithet having the meaning of causing rough swellings.

Norris (D. O.) & Hutton (E. M.). **Pea mosaic with special reference to its effect on yield of seed.**—*J. Coun. sci. industr. Res. Aust.*, xvi, 3, pp. 149–154, 1943.

In an experiment conducted at Canberra in 1942, the mosaic-resistant pea variety William Massey [*R.A.M.*, xix, p. 252] showed a greater capacity to emerge under cold and wet soil conditions than did the susceptible Greenfeast, their

average emergence being 72·6 and 50·7 per cent., respectively. Infection of Greenfeast peas with mosaic virus in the seedling stage reduced the yield by 17·4 per cent., while infection at any later stage had no significant effect on yield. Natural transmission of the virus appeared to be mainly due to aphids crawling from row to row and not to the flying forms. Spraying with nicotine and soft soap once a week against the vectors had no effect on the spread of mosaic. It is considered that in Australia, where red clover, which serves in New Zealand both as a perennial host for the virus and as a breeding-ground for the vectors, is of little importance; where aphid populations, probably owing to the general aridity of the climate, are not dense; and where, finally, pea crops are dispersed geographically, mosaic is not likely to be of commercial importance, at least not for the production of dried seed.

WARE (W. M.) & GLASSCOCK (H. H.). **Cucumber virus 1 in ridge Cucumbers.**—*Gdnrs' Chron.*, Ser. 3, cxiv, 2971, p. 212, 1943.

In mid-July, 1943, outdoor cucumbers in an east Kent nursery were attacked by a virus identified by F. C. Bawden as that of cucumber mosaic, the varieties affected being Stockwood Ridge, King of the Ridge, and Telegraph. On inspection of the planting at the end of the month 147 out of a total of 1,030 plants had been removed and many others were diseased or dead. Sporadic infection also occurred on a second plantation of 5,000 plants covering two acres in another part of east Kent, while specimens were further received from a third nursery (in Sussex) in which 200 out of 800 plants had been killed. The virus is thought likely to have been involved in a prevalent wilting and death of ridge cucumbers in the same regions in 1942, while according to F. C. Bawden, similar symptoms have been observed in the Harpenden (Herts.) allotments.

VAN HALTERN (F.). **No more bad years for Watermelons. New wilt-resistant variety developed at Georgia A. E. S.**—Reprinted from *Sth. Seedsm., 1943*, January, 1 p., 3 figs., 1943.

A new variety of watermelon, resistant to wilt [*Fusarium bulbigenum* var. *niveum*: *R.A.M.*, xxii, p. 127], named Georgia Wilt-Resistant, has been developed at the Georgia Experiment Station from a cross between Cuban Queen and a wilt-resistant melon which was probably one of the earlier strains of Iowa Belle. In 1941 and 1942 the new variety produced good crops where other varieties were complete failures in 1940 because of wilt.

HICKMAN (C. J.). **Shanking: a new disease of Onion and Shallot.**—*Gdnrs' Chron.*, Ser. 3, cxiv, 2964, p. 140, 2 figs. (on pp. 141, 142), 1943.

Onions and shallots in the southern half of England appear to be widely affected by a new disease. The leaves turn yellow and shrivel up, and in young plants there is a softening of the basal tissues enclosed by the outer leaf sheath, while in older plants the bulb itself may be soft. The outer leaf bases sometimes have a dull, water-soaked appearance. The roots become similarly affected, but quickly dry up when exposed to the air. When a diseased plant is cut open longitudinally, the swollen bases of the youngest leaves surrounding the growing point are found to be discoloured and often much contracted. Sometimes there is no contraction, but the swollen leaf bases are uniformly soft and water-soaked. As a rule, there is a distinct demarcation line between the green, healthy tissues and the dull, buff-coloured, infected tissues below. Infected material invariably showed the presence of a species of *Phytophthora*. Bulb-softening and the absence of any external mycelium are characteristic features of the condition, which may aptly be termed shanking [cf. *R.A.M.*, xviii, p. 183].

Shanking was noted in autumn and spring-drilled onions, as well as among plants

raised in boxes. It was generally found occurring in scattered patches; in one case the loss of 1,400 out of 5,000 plants was reported, while in another planting of two acres there was an area of about $\frac{1}{5}$ acre in which an average of 21 per cent. of the plants had been destroyed. The disease is probably soil-borne, but does not appear to be correlated with any particular soil conditions. It is possible that losses may also occur in storage.

STOLLER (B. B.). **Preparation of synthetic composts for Mushroom culture.**—*Plant Physiol.*, xviii, 3, pp. 397–414, 2 diags., 1943.

The synthetic composts for mushroom (*Agaricus* [*Psalliota*] *campestris*) culture [cf. *R.A.M.*, xxi, p. 182] described in this paper have been tested at the L. F. Lambert Research Laboratory, Coatesville, Pennsylvania, over a period of five years; the yields obtained being as good as, or better than, those from horse manure composts. The composition of the synthetic compost was based on the analyses of horse manure and mushroom, which are tabulated. As a result of extensive experimentation it was found that a satisfactory synthetic compost should contain about 13 lb. nitrogen, 4 lb. P_2O_5, and 10 lb. K_2O in 1 ton of fibrous material having 70 per cent. moisture, allowing for the quantities of these three constituents present in the fibrous material. The sources from which these constituents are derived are immaterial as long as the above-mentioned quantities and ratio are maintained. Spent licorice roots (from which the licorice has been extracted) and spent tannery nuts, bark, and leaves (from which tannin has been extracted) were more satisfactory than straw. Organic nitrogenous materials were preferable to inorganic ones and the best source of phosphorus was superphosphate. The importance of potash was demonstrated in one experiment in which its addition to composts prepared from spent licorice roots and brewers' grains gave almost double the yield from composts to which only nitrogen and phosphorus were added. In preparing the compost the nitrogenous material is spread or sprayed over the surface of the flattened heap of fibrous material and forked in about 1 ft. deep, all mineral ingredients are then mixed together, diluted with an equal quantity of loam, and spread evenly over the top of the heap, which is then mixed, watered as it is turned, and arranged into a pile with sufficient aeration. The length of the composting period was about four to five weeks for piles made with straw, eight days for small piles of licorice root composts (950 lb.), and 15 to 20 days for large ones (approximately 22,000 to 25,000 lb.). Large piles must have a ventilator in the centre to insure good aeration. The best yields were obtained by using 12 bush. compost for 24 sq. ft. bed surface, the compost heating to the high temperature of 140° F. necessary for killing pests.

Soaking nitrogenous materials in solutions of lignin or tannin extracts, designated as 'coprinating' agents, rendered the lengthy outdoor composting unnecessary and produced greater yields. The disadvantage of using these solutions lies in their acidifying nature, which makes composts more susceptible to the truffle disease, *Pseudobalsamia microspora* [ibid., xx, p. 512]. To make conditions unfavourable for this fungus and also in order to insure sufficient volatilization of ammonia, which is an important factor for killing the spores of *P. microspora*, the P_H of the compost should be adjusted to from 8 to 8·5. This value is highly favourable to *Coprinus* spp. (chiefly *C. fimetarius*), but these invaders are not as dangerous to the crop as *P. microspora*.

TRESCHOW (C.). **Die Bedeutung der Wuchsstoffe für Psalliota hortensis.** [The significance of growth substances for *Psalliota hortensis*.]—*Naturwissenschaften*, xxxi, 16–18, p. 210, 1943.

At the Copenhagen Veterinary and Agricultural College the author studied the growth substance requirements of the cultivated mushroom, *Psalliota hortensis*

Lange [cf. preceding abstract], which was cultured on 50 c.c. of a synthetic solution containing glucose, asparagin, and the essential salts in conical flasks of 300 cm. capacity, each flask being inoculated with 0·25 sq. cm. mycelium from a glucose agar pure culture. Growth substances were supplied as follows: (1) 0·10 γ biotin; (2) 0·10 γ biotin+100 γ d, 1-sodium pantothenate+100 γ nicotinic acid amide+25 γ aneurin; (3) 0·5 c.c. beer wort, 12° Balling; (4) control. After 30 days the mycelial weights per 50 c.c. medium were (1) 16, (2) 68, (3) 63, and (4) 4 mg. Experiments with horse manure, to be fully described at a later date, showed the beneficial effects of this medium to be partially due to its growth substance content.

LYON (A. V.) & WALTERS (D. V.). **Production of dried Grapes in Murray Valley irrigation settlements.**—*Bull. Coun. sci. industr. Res, Aust,* 143, 48 pp., 3 figs., 6 graphs, 1 map, 1941. [Photo-lithographed.]

The following items of phytopathological interest occur in this comprehensive account of the viticultural aspects of dried grape production in the Murray Valley, where the cultivation of vines for this purpose is carried on over an area of 57,000 acres between Woorinen, Victoria, and Mypolonga, South Australia. An endophytic fungus is invariably associated with the mature rootlets, and is parasitic at first; but the host rapidly reacts to its presence, and partial digestion of the hyphae takes place. Fungus diseases are readily combated and have been of minor importance in recent years. In seasons conducive to its development, however, black spot [*Elsinoe ampelina*] may cause the loss of an entire crop. The practice of removing all the diseased shoots is seldom necessary with up-to-date facilities for control. It was carried out, however, on a large scale in 1918, and the productivity of the canes noted in the following year. With early (October) removal one-half to three-quarters of a full crop was harvested, whereas the same operation in late November reduced the yield to the unprofitable level of 5 cwt. per acre.

LENNETTE (E. H.). **Recent advances in viruses. A brief survey of recent work on viruses and virus diseases.**—*Science*, N. S., xcviii, 2550, pp. 415–423, 1943.

In this paper presented before the Seminario de Biologia, held in Rio de Janeiro in July, 1943, under the auspices of the University of Brazil, the author deals mainly with viruses pathogenic to man and animals, and discusses, *inter alia*, their nature, chemistry, and antigenic structure.

HOAGLAND (C. L.). **The chemistry of viruses.**—*Ann. Rev. Biochem.*, xii, pp. 615–638, 1943.

This is a critical survey of recent studies on virus chemistry, summarized under the following headings: methods of isolation and criteria of purity of viruses; composition and structure; chemical derivatives of tobacco mosaic virus; molecular size and shape of purified viruses; electron microscopy of viruses; X-ray studies on viruses; antigenic structure of viruses; studies on virus metabolism; and effects of enzymes and reagents on purified viruses.

MOORE (W. C.). **Diseases of crop plants. A ten years' review (1933–1942).**—*Bull. Minist. Agric., Lond.*, 126, 100 pp., 18 figs., 1 map, 1943.

This review of fungous, bacterial, and other diseases of crops for the years 1933 to 1942 gives a most precise and comprehensive picture of the plant disease situation in England and Wales. Among the many interesting records the following are worthy of special mention.

Black rust (*Puccinia graminis*) of wheat is stated to be most common in south-west Wales where barberry is abundant, but also to occur, though to a lesser degree, in most years elsewhere. In 1934 and 1935 the disease was not reported, while in 1937 it was above normal, and in 1940 appeared in August in epidemic

form in many parts of the country, being unusually severe in Yorkshire and Worcestershire. Late attacks by this rust are considered to be due to wind-blown uredospores rather than to the proximity of barberry bushes, this explanation being offered for the 1940 epidemic, as the prevailing winds in June of that year are known to have been favourable to the transport of uredospores from the Continent. This rust is occasionally found on *Mahonia* [*Berberis*] *aquifolium*, but neither this nor any garden species of *Berberis*, except *B. vulgaris*, is of economic significance in the spread of the disease. Yellow rust (*P. glumarum*) of wheat is often scarce in years following high summer temperatures, but is sometimes also scarce after cool summers, so that factors other than high temperature probably play a big part in the incidence of the disease.

Perithecia of *Gibberella zeae* [*R.A.M.*, xxii, p. 349] were found on seed of oats and barley in Cornwall, and on oat straw in Westmorland in 1940; the fungus was also observed at two places in Cumberland in 1941, and chiefly on oats but also on wheat and barley in widely scattered districts in mid-Wales in 1942, where a severe attack of ear blight had developed by harvest time and perithecia were present in profusion on the outer pales and grain. Black oat varieties remained comparatively free from attack by this fungus.

Relatively few records of grey leaf (manganese deficiency) of oats [ibid., xxii, p. 428] were received up to 1940, and these came mainly from Yorkshire, Northumberland, Lancashire, and Cardiganshire; but from 1940 to 1942 the disease was observed in other parts of the country as well, especially on newly-ploughed grassland on calcareous soils or where the soil had been heavily limed. In Yorkshire the disease is common on black soils containing much humus or lignin, which may overlie sand or heavy clay, or on fen and carr land where the soil reaction is neutral or alkaline. It caused much havoc there in 1941, partly, possibly, as a result of the liming campaign, partly because it was greatly aggravated by drought.

Of 100 barley seed samples representative of over 2,000 received at the Official Seed Testing Station at Cambridge from December, 1941 to January, 1942, only 9 were clean while 23 showed up to 20 per cent., 31 from 20 to 50 per cent., and 37 over 50 per cent. infection with the leaf stripe fungus, *Helminthosporium gramineum* [ibid., xxii, pp. 201, 300]. Leaf blotch of barley (*Rhynchosporium secalis*) [ibid., xxi, p. 154] has been troublesome for some 20 years in East Anglia and has lately been of more consequence than leaf stripe, which is no longer considered serious there.

The distinction made between the name 'spraing' [ibid., xviii, p. 201] applied to a potato tuber disease with arc-like lesions, and the term 'internal rust spot' [loc. cit.] reserved for one with a blotch type of symptom, is considered to be not quite beyond dispute, as both symptoms occur mainly in potatoes grown in dry, stony, sandy, or gravelly soils, usually deficient in organic matter, potash, and lime, and are not uncommonly found on the same tuber. The precise cause of both types is still unknown. Spraing is widely distributed and was reported every year, most often from Yorkshire and the north-west; it was very slight in 1936 and 1942, more prominent than usual in 1937 and 1938, and most prevalent in 1941. About 75 per cent. of a crop of Arran Pilot was severely affected in Cardiganshire in 1937, and 60 per cent. of a crop of Arran Banner in Berkshire in 1941. Internal rust spot is equally widely distributed; it was not reported in 1933 and 1942, or outside the Bristol Province in 1940, and was worst in 1938, particularly in Yorkshire. In 1935, 5 to 6 tons of Great Scot in Yorkshire proved unsaleable on account of it. Arran Consul is the safest variety to grow where these diseases are apt to occur badly, and on land not so prone to them King Edward may be grown profitably.

Spindling sprout of potatoes is not common, and was not reported except in 1936. There is no evidence that this disorder is of virus origin. In France, where it

has been known for over a century, it is believed to be a non-parasitic trouble apt to occur in dry regions or in other areas after abnormally dry summers; in the United States it is chiefly a trouble of southern-grown seed; and in Germany it was described as prominent in some districts in 1912 after an exceptionally dry summer of the previous year. Under such dry conditions the tubers remain still young, perhaps only half-grown, with their eyes only partially developed; when lifted they prematurely ripen off and commonly produce spindling sprouts. Similar symptoms can sometimes be induced if a break is made in the rest period during storage.

Symptoms suggestive of yellow dwarf [ibid., xxi, pp. 442, 443] appear to be fairly common in shallots and, to a lesser extent, in onions, but little attempt has yet been made to identify the trouble definitely or to distinguish it from mosaic due probably to cucumber mosaic virus.

Perithecia of *Leptosphaeria coniothyrium* were observed on young maiden apple trees in Cheshire in 1938. Infection appeared to have entered where the shoots had been pruned and to have spread downwards to soil-level.

Silver leaf (*Stereum purpureum*) [ibid., xxi, p. 459] of plum is still widely distributed and prevalent; more so in 1937 and from 1939 to 1941 than in the other years. The disease tends to be worse after a heavy cropping season, when branches are broken and the fungus can enter through the wounds thus made. A survey carried out in Essex in 1941 showed that silver leaf occurred most commonly in well-kept orchards that cropped heavily. High winds may also lead to abnormal breaking of branches. The fact is stressed that affected trees often recover without treatment and that they do not become a menace to neighbouring trees until the branches begin to die.

Browning and stem-break of flax (*Polyspora lini*) [ibid., xxii, p. 358] was first reported in 1941 from Lincolnshire and Nottinghamshire, but is known to have been present in the eastern counties at least a year or two before then. In 1942 it was very common in northern Pembrokeshire, causing from 1 to 90 per cent. infection (an average in 12 crops of 45 per cent.). The disease appreciably reduced the yield and the viability of the seed. Wilt (*Fusarium lini*) and 'pasmo' (*Phlyctaena linicola*) [*Sphaerella linorum*] have not yet been recorded in this country, but in 1942 an unidentified species of *Fusarium* was associated with yellowing and stunting or with wilting of flax seedlings in Warwickshire, Yorkshire, the east Midlands, and Norfolk [cf. ibid., xxiii, p. 17].

Reports of cucumber mosaic virus causing browning of lupins [ibid., xviii, p. 784] are stated to have increased since 1936, especially from the southern half of the country.

Meier (K.). **Bericht der eidgenössischen Versuchsanstalt für Obst-, Wein- und Gartenbau in Wädenswil für das Jahr 1940.** [Report of the Federal Experiment Station for Fruit-Growing, Viticulture, and Horticulture at Wädenswil for the year 1940.]—*Annu. agric. Suisse*, lvii, 5, pp. 419–461, 1943.

The following items of phytopathological interest, besides those already noticed from other sources, occur in this report. C. Hadorn's experiments on the control of celery blight (*Septoria apii*) demonstrated the efficiency of copper oxychloride preparations, notably cuprenox, which increased the yield by 67 per cent. over that of the untreated plots.

Rose diseases, including true and downy mildews [*Sphaerotheca pannosa* var. *rosae* and *Peronospora sparsa*, respectively], black spot [*Diplocarpon rosae*], rust [*Phragmidium mucronatum*], and leaf spot, were found to be controllable by weekly treatments, from the inception of renewed growth until the end of June, of a combined sulphur-copper-derris dust, followed from July to the end of September by a monthly application of a copper spray, e.g., 0·3 per cent. copper

oxychloride (32 per cent.)+0·05 per cent. of a spreader, supplemented during the intervening periods by dusting with sulphur-copper acetate at 10- to 14-day intervals.

Among the new plant-protectives analysed by C. Zäch during 1940 may be mentioned thiovit (Sandoz A.G., Basle), a sulphur 'wetter' particularly well adapted for combination with Bordeaux mixture, agrolit (later designated agrokupfer), a useful copper oxychloride spray supplied by Agro-Chemie Klingnau, with a guaranteed copper content of 32 per cent.; and carbylkupfer (Pflanzenschutzmittelfabrik E. Hungerbühler, Brugg) a basic copper sulphate spray for spring and summer use, with a guaranteed copper content of 46 per cent., the physical properties of which at a strength of 1·4 per cent. were adjudged to be satisfactory (also in combination with carbolineum); and etaldyn (Maag, Dielsdorf/Progil, Lyons), a pale yellow, clear liquid, soluble in water to give a practically neutral, dully opalescent solution with good wetting properties [see next abstract].

Faes (H.). **Station fédérale d'essais viticoles et arboricoles à Lausanne et Domaine de Pully. Rapports annuels 1941 et 1942.** [Annual reports for 1941 and 1942 of the Federal Viticultural and Arboricultural Experiment Station at Lausanne and Domaine de Pully.]—*Annu. agric. Suisse*, lvii, 5, pp. 462–498, 1943.

These reports [cf. *R.A.M.*, xxi, p. 279] contain, *inter alia*, the following items of phytopathological interest. In 1941 a series of experiments was carried out, in collaboration with other Stations in various parts of Switzerland, to determine the possibility of combining effective treatment of vines against downy mildew [*Plasmopara viticola*] with the stringent economy in copper dictated by the military situation [ibid., xxi, p. 497 *et passim*]. The best results were obtained with 1·5 or 2 per cent. Bordeaux mixture, with the addition of an adhesive to the lower concentration. On 2nd September the loss of grapes and leaves on the stocks treated with the 2 per cent. mixture and with the 1·5 per cent. plus cuprofix amounted to only 0·2 and 0·4 per cent., respectively. Used at a strength of 1 per cent. the Bordeaux mixture conferred a slightly lower, but still commercially sufficient degree of protection, the losses ranging from 1·8 to 2 per cent.; a reduction of the concentration to 0·5 per cent., however, definitely exceeded the limits of safety, permitting a 7 per cent. decrease in yield. A noteworthy observation was further made in connexion with the purity of the copper sulphate component and the efficacy of the mixture. Thus, with a purity of 99 per cent., the 1 per cent. Bordeaux allowed a loss from mildew of only 1 per cent., the corresponding reductions for the 93·5 and 89·9 per cent. purities being 3 and 3·2 per cent., respectively. Outside the experimental plots the Domaine de Pully vineyards were effectively treated with five applications of 1·5 per cent. Bordeaux mixture, the unsprayed controls being a total loss. A new copper product (Sandoz, Basle) gave excellent control, with only 0·15 per cent. reduction of yield. Three substitutes for copper included in the tests gave unsatisfactory results.

In 1941 grapes inoculated with the 'coître' fungus (*Coniothyrium diplodiella*) on 20th August and then sprayed with 0·5 per cent. cryptonol (oxyquinolin)+0·1 per cent. cuprofix showed only 4 per cent. infection on 13th October, compared with 74 per cent. on the untreated controls. In 1942, when the disease was very severe following numerous hailstorms, causing an average reduction of 20 per cent., very promising results were obtained with pure copper sulphate (300 gm. per hl.)+0·1 per cent. etaldyn [see preceding abstract], which reduced the loss to 4·8 per cent., while cryptonol, used on an extensive scale, was even more effective with a decrease of the damage to 1·3 per cent.

The ink disease [*Phytophthora cambivora*] appeared in some of the chestnut groves of Monte Ceneri, Ticino, for the first time. Experiments have been initiated

in situ with a view to preventing the spread of infection and the restoration of the less severely affected trees.

Satisfactory resistance to apple scab [*Venturia inaequalis*] was shown in 1941 by the Jonathan, Ontario, Reinette Ananas, Reinette de Champagne, Reinette de Chevroux, Reinette grise Parmentier, and Transparente blanche varieties. Protection against the majority of apple pathogens was secured by the following spray schedule: 26th February, 4 per cent. carbolineum; 22nd April, 2 per cent. lime-sulphur (22° Baumé)+200 gm. copper oxychloride; 23rd May, 1·5 per cent. lime-sulphur+0·5 per cent. lead arsenate; 3rd June, 1·5 per cent. lime-sulphur+50 gm. copper carbonate; 26th June, 1·5 per cent. lime-sulphur+1 per cent. lead arsenate; 15th July, 0·4 cupritox (on late varieties); 13th August and 5th September, 150 or 100 gm. copper carbonate on varieties susceptible to late scab.

Botany and plant pathology section.—*Rep. Ia agric. Exp. Sta., 1940–41*, Part I, pp. 119–135, 2 figs., 1 map, 1943.

This report on plant disease work in Iowa in 1940–1 [*R.A.M.*, xx, p. 343] contains the following items of special interest. In breeding studies with 85 strains of watermelons conducted by A. W. Welch and I. E. Melhus, one unnamed strain resistant to both wilt [*Fusarium bulbigenum* var. *niveum*: see above, p. 86] and anthracnose [*Colletotrichum lagenarium*] showed much promise, becoming infected with anthracnose about ten days later than the susceptible varieties and remaining alive and maturing melons two weeks after the susceptible varieties were dead. Seed of the new striped, wilt-resistant Dixie hybrid was released during the year. Preliminary investigations indicated that there is a definite succession of root parasites on watermelon plants; *Pythium*, *Fusarium*, and *Rhizoctonia* were isolated in the order named. *Pythium* and *Rhizoctonia* caused serious damage and appeared to influence infection by the wilt organism, but the exact nature of that relationship is not yet known. Blossom-end rot, caused probably by *P. acanthicum*, was very severe on the watermelon variety Hawkesbury, rendering in one field as much as 49 per cent. of the set fruit of that variety unmarketable. The disease was found only occasionally affecting other varieties. Inoculations with *P. acanthicum* were, however, unsuccessful with Hawkesbury melons that had normal blossom-end tissue, wounds or any dead areas that might develop around the floral scar being essential for infection. One collection of the parasite was capable of penetrating the pericarp of very young melons.

H. C. Murphy reports that races 1, 6, and 7 of crown rust of oats [*Puccinia coronata*] were the most widespread and prevalent in 1940. An epiphytotic of halo blight of oats (*Bacterium* [*Pseudomonas*] *coronafaciens*) was present throughout Iowa in 1940. Fortunately a large portion of the selections of hybrid origin in the nursery at Ames were resistant, particularly those with Bond as one parent. Isolations from field collections yielded 15 pathogenic cultures of *P. coronafaciens* and two of *Bact. striafaciens* (the cause of stripe blight). Of the 30 oats varieties included in 42 uniform rust nurseries grown in 27 States in 1940, 18 were of hybrid origin and resistant to either or both crown or stem rust [*P. graminis avenae*], all except one being also resistant to loose and covered smuts [*Ustilago avenae* and *U. kolleri*]. Of these varieties of hybrid origin 12 had Victoria as one parent and were resistant to both smuts and crown rust, four of them (Boone, Control, Tama, and Vicland) being also resistant to stem rust. The two Bond-hybrid selections (C.I. 3543 from a cross with Iogold, and C.I. 3483 from a cross with Morota) had an average coefficient of crown rust infection of 0·29 compared with 0·01 for Bond, ranking next to Bond itself among all the 30 varieties under observation, with the exception of one lapse on the part of C.I. 3483, which had a recorded coefficient of 20·0 in one nursery. Both hybrids are resistant to stem rust and to most races of both smuts.

In field tests conducted by I. E. MELHUS sweet potato varieties Schumaker, Maryland Golden, and Priestly were found to be more resistant to stem rot [*F. batatatis* and *F. hyperoxysporum*] than were the Yellow Jersey, Nancy Hall, and Noltes. The most resistant among them, Schumaker, showed an 80 per cent. stand at digging time with 37 per cent. healthy plants; the most susceptible, Noltes, a 56 per cent. stand with 20 per cent. healthy plants. Dip treatments of slips against stem rot resulted in all cases in less growth and poorer stands during the first month than in the untreated controls; but at the end of the season the percentage of healthy plants following treatment with P.D. 7 and cuprocide was in Schumaker 58 and 65 per cent., respectively, as compared with 44 per cent. in the control, and in Noltes 46 and 39 per cent., respectively, as compared with 33 per cent. in the controls. A dip treatment with a mixture of aniline oil and mercuric chloride was in no case beneficial, and none of the treatments had any effect on the Nancy Hall variety. Vine cuttings of sweet potatoes were no more resistant to stem rot than slips, but when planted in steamed soil for two weeks prior to transplanting into the field, they showed 100 per cent. healthy plants, even when after being thus started in steamed soil they were dipped in a spore suspension of the stem-rot organisms and then planted in artificially infected soil. There is evidence from a limited number of experiments, supported by field observations, that the organisms do not enter the plant through the roots. Where diseased runners were found, the point of entry was a definite wound.

G. SEMENIUK and I. E. MELHUS state that the yellow dwarf virus disease of onions has been held in check by the control measures applied, and is now infrequent in the State. During the 1940 season neck rot [*Botrytis allii*], which had been of minor importance in previous years, became epiphytotic in the peat land onion districts causing losses of 50 per cent. in about 10 per cent. of the fields.

I. E. MELHUS, J. N. MARTIN, and H. C. MURPHY report that an examination of the root systems of apparently healthy lucerne seedlings grown on slightly acid soil revealed slight to severe discoloration of the primary and secondary roots. Isolations from these diseased roots yielded in most cases *Fusarium* spp., and only occasionally, from very young seedlings, *Pythium de Baryanum*. In greenhouse experiments soil infected with the *Fusarium* isolates yielded 100 per cent. healthy seedlings, whereas soil infected with those of *P. de Baryanum* yielded 100 per cent. diseased seedlings. No appreciable difference was observed in seedling stands of lucerne on limed or unlimed soil.

In fungicide tests conducted by C. S. REDDY, E. L. WALDEE, I. E. MELHUS, and R. H. PORTER, two lots of potato seed, one very scabby and the other free from scab but showing *Rhizoctonia* [*Corticium*] *solani* sclerotia, were treated with semesan bel, mercurnol, cinnex-20, acidulated mercuric chloride, yellow oxide of mercury, hot formaldehyde, and an ethyl mercury chloride instant dip. All treatments caused either an increase in yields or at least no injury to scabby potatoes, but in the case of scab-free seed no yield increases were obtained and yellow oxide of mercury and cinnex-20 caused marked injury, resulting in a reduction of about 30 per cent. in the average yield. With both lots of seed the ethyl mercury chloride instant-dip treatment appeared to give as much protection from seed-borne pathogens as did hot formaldehyde.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liv, 10, pp. 463–466, 6 figs., 1943.

Citrus psorosis [*R.A.M.*, xxii, pp. 62, 63] was first observed in New South Wales about 15 years ago, but so far it has not been of much economic importance. The light-coloured flecks found in California near the smallest veins of young leaves are not present locally. If the disease appears in a few trees in a block, the others should be inspected at regular intervals for early symptoms. If these are found,

the infected tissue should be removed and the wound disinfected. Trees in which the disease has progressed too far for treatment to be of any use should be retained as long as they continue to produce valuable crops, as they may do for years. Budwood should never be taken from affected trees, or from trees known to have come from the same source as infected trees.

In 1942 much wastage occurred in early dug potatoes, some of it being due to rotting by *Fusarium* spp. and *Pythium* spp. following on mechanical injury. Injured and diseased tubers should not be bagged with healthy ones before storage.

Baker (R. E. D.) & McKee (R. K.). **Witches' broom disease investigations. VI. The infection of flower cushions and pods of Cacao by Marasmius perniciosus Stahel.**—*Trop. Agriculture, Trin.*, xx, 10, pp. 188–194, 12 figs., 1943.

In further studies on cacao witches' broom (*Marasmius perniciosus*) [*R.A.M.*, xxiii, p. 9] in Trinidad, 262 cushions were inoculated, of which 60 became infected. These ranged from those bearing minute flower buds to those with grown flowers, symptoms generally appearing in three to five weeks. All the types of infected cushion found in the field were reproduced. Twenty-six cushions developed both infected vegetative shoots and abnormal flowers, two produced shoots only, and 32 formed only infected flowers. On the experimentally infected cushions two indirectly infected pods were formed, which grew to a length of a few centimetres and then rapidly turned brown; neither had developing ovules.

Of 594 cherelles inoculated, 102 became infected, though in one experiment 62 per cent. of the inoculations were successful. Cherelles up to 6 cm. long were infected, and the evidence indicated that all cherelles shorter than this are equally susceptible. The period that elapsed between inoculation and the first appearance of the symptoms ranged from three weeks to four months. Successful inoculation of cherelles under 3 cm. long generally resulted in the appearance of symptoms in four to six weeks. Larger cherelles, when inoculated, seldom develop distortion, and show symptoms only after the pod has begun to ripen. Small cherelles are sometimes infected without resultant distortion. A number of systemically infected pods developed from small infected cherelles about 1 cm. long when inoculated, and in these necrosis often did not occur until three months after infection.

Damage to the pod depended on its size when infected. A small infected cherelle generally fails to reach maturity, while cherelles infected when 4 cm. in length or more may ripen with some of the beans undamaged, though even in this case all the beans may be killed, particularly if the pod is not picked directly it ripens. In no case was infection restricted to the shell.

Greaney (F. J.) & Wallace (H. A. H.). **New and standard seed treatments in the control of certain seed-borne diseases of Wheat, Oats, and Barley.**—*Phytopathology*, xxxiii, 11, pp. 1064–1070, 1943.

Field experiments were conducted at several Canadian stations in 1942 to determine the relative value of certain standard and new fungicides for the control of the seed-borne pathogens, *Ustilago avenae*, *U. levis* [*U. kolleri*], and *Helminthosporium avenae* on oats, *H. sativum* causing seedling blight of wheat and barley, and *U. hordei* on barley. All the seed used in the tests had contracted heavy spontaneous infection in the previous season.

Ceresan, leytosan (both at the rate of ½ oz. per bush.), and ceresan dip (1 in 800, three minutes) gave excellent control of all the diseases, while formalin dip (1 in 320, three minutes) was effective against the smuts, but failed to eliminate *H. sativum* on barley or *H. avenae* on oats. Spergon, thiosan, and three unnamed dusts were unsatisfactory for the purpose in view.

Pugsley (A. T.) & Phipps (I. F.). **The combination of stem rust resistant genes from the wheats Eureka and Warigo.**—*J. Aust. Inst. agric. Sci.*, ix, 3, pp. 130–132, 1943.

Under field conditions at the Waite Institute, South Australia, the Eureka wheat variety has always been resistant to *Puccinia graminis tritici*, but a disturbing outbreak on this variety in 1942 was reported in New South Wales by S. L. Macindoe in a private communication indicating that no single gene or genes from one variety will provide complete resistance. Combination of genes from varieties each carrying resistant genes will probably confer greater resistance. In tests with seedlings at low temperatures and using race 34 of the fungus the authors found a single gene difference in crosses between Eureka (resistant) × Dundee (susceptible) and Eureka (resistant) × White Federation 38 (susceptible). Field trials at the Waite Institute, where race 34 of the fungus predominates, failed to give any indication of the number of genes determining the resistance of Warigo. Modifying factors appear to be present, for in crosses between Warigo and susceptible varieties the F_1 is intermediate in its reaction to rust, and the F_2 and F_3 families segregate in a complex manner without a clear-cut segregation.

At 60° F., Eureka seedlings are resistant, and Warigo susceptible, to race 34. In 1942 and 1943 evidence was obtained from an F_2 of this cross that the low-temperature resistance of Eureka seedlings to this race depends on the presence of a single dominant gene. This was confirmed in tests with F_3 families. In field tests in 1941 F_2 and F_3 rows of (Eureka × Warigo) were subjected to a severe natural epidemic of race 34. Both parents were strongly resistant, but susceptible segregates appeared in both the F_2 and F_3 families. The field results, in contrast to the seedling tests with this material, indicated that in the cross (Eureka × Warigo) two independently inherited dominant genes for resistance operate. The progenies of susceptible field segregates were susceptible in the field and as seedlings in the glasshouse. Of the progeny from the field resistant segregates, some were homozygous resistant and others segregated when tested as seedlings. This behaviour provides a short-cut method for isolating the desired double dominant combination of genes.

Adopting a method suggested by Macindoe (unpublished thesis, University of Minnesota, 1941), the authors combined the physiologic resistance of Eureka with the mature-plant resistance of Warigo. Remnant seed of the more promising F_3 rows of (Eureka × Warigo), which were also homozygous resistant in the field in 1941, was available for testing as seedlings in the glasshouse in 1942. The F_3 families segregating with resistant and susceptible seedlings were selected. These, while heterozygous in the seedling stage to race 34, are homozygous resistant at maturity, the homozygosity being that of the mature-plant resistance genes. To obtain homozygosity of the physiologic resistance genes also, resistant seedlings were selected and their F_4 progenies tested in the seedling stage in 1943. A family (6543) homozygous for the physiologic resistance genes was obtained, which had the mature-plant resistance of Warigo and the physiologic resistance of Eureka.

Watson (I. A.). **Inheritance studies with Kenya varieties of Triticum vulgare Vill.**—*Proc. Linn. Soc. N.S.W.*, lxviii, 3–4, pp. 72–90, 1 pl., 1943.

The valuable resistance to many races of stem rust (*Puccinia graminis tritici*) of two wheat varieties, Kenya 744 and Kenya 745 [*R.A.M.*, xx, p. 522], was found to be controlled mainly by a single major factor in each variety. Seedling and adult plant resistances to the disease were highly correlated, but the factors governing the two forms were not allelic in the two varieties. Kenya 745 has a single major factor, K_1, for resistance to races 1, 11, 14 (one culture), 15 (two cultures), 17, 21, 34, 36, 38 (one culture), 47, 49, 56, 69, 80, 97, 117, and 147, but

two factors, K_1, and K_2, unequal in their effects, appear to operate against races 14, 19, 38, and 59, the more efficient being the former, which confers resistance to races in the larger group. F_3 lines selected for resistance to any race in the first group will therefore be automatically resistant both to others in the same group and to those of the second. However, the converse does not necessarily apply, i.e., lines selected for resistance to the second group of races will not be invariably resistant to those of the first. Races 14 and 38 contained biotypes which gave reactions on the differential varieties typical of the race concerned. Two such biotypes could be distinguished in each race, tests on F_3 lines indicating that Kenya 745 had one factor for resistance to one biotype, and two factors for resistance to another of the same race.

Kenya 744 was also resistant to both races of powdery mildew (*Erysiphe graminis tritici*) present at the Minnesota Agricultural Experiment Station, where most of the work herein described was carried out.

WATSON (I. A.) & BAKER (E. P.). **Linkage of resistance to Erysiphe graminis tritici and Puccinia triticina in certain varieties of Triticum vulgare.**—*Proc. Linn. Soc. N.S.W.*, lxviii, 3–4, pp. 150–152, 1943.

The Thew and Kenya 744 wheat varieties are resistant to race 1 of *Erysiphe graminis tritici* and race 95 of *Puccinia triticina* [*R.A.M.*, x, p. 367 and preceding abstract]. In each variety resistance to both diseases appears to be controlled by the identical gene or by two very closely linked genes. The Kenya gene is allelic to that in Thew.

ATWOOD (H.) & THOMAS (R. C.). **Eradication of three and a half million Barberry bushes protects Ohio grain from stem rust.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxviii, 224, pp. 193–197, 2 figs., 1 map, 1943.

In this popular note on stem rust of cereals [*Puccinia graminis*] in the United States and its control the writers state that the average annual loss due to the disease in Ohio alone was reduced from 7,500,000 bush. during the period 1916 to 1927 to 4,000,000 from 1928 to 1939, primarily through the eradication of the common barberry bushes serving as the alternate host of the pathogen. Since 1918, 3,262,000 bushes have been destroyed on 17,000 properties, and an intensive survey has been conducted over an area of more than 30,900 sq. miles, or about three-quarters of the State, every county of which has been found to contain barberries. Periodical reinspections are essential as long as there is any risk of renewed growth of the shrubs on the cleared areas: in 80 of the 88 counties bushes were found to have escaped from cultivation and produced seed for years before their destruction. Over 100 cases are on record in 42 Ohio counties in which local epidemics could be traced directly to the presence of barberries, in some cases at a distance of four or five miles from the crops.

The cultivation of rust-resistant varieties is the best method of combating epidemics of the disease conveyed by wind-blown spores from the south (Texas and northern Mexico), such as occurred in the Mississippi Valley in 1935, 1937, and (in a less severe form) in 1938 [cf. *R.A.M.*, xxiii, p. 59].

MACHACEK (J. E.). **An estimate of loss in Manitoba from common root rot in Wheat.**—*Sci. Agric.*, xxiv, 2, pp. 70–77, 1943.

The following procedure was adopted for the estimation of losses in Manitoba from common root rot in wheat (caused chiefly by *Helminthosporium sativum* and *Fusarium culmorum*) [*R.A.M.*, xxii, p. 426]. The entire wheat-growing area was divided into soil zones, and these in turn into sampling locations about equal

distances from one another. Altogether 60 wheat fields were thus selected, from each of which ten samples of plants were taken at maturing time from points separated by 50-pace intervals from each other. The ten samples were tied in one bundle and marked with the sampling location number. Later all bundles were opened in the laboratory, the plants within each classified into groups according to the severity of root rot in them, the plants and the spikes in each group counted, and, after the groups of plants from each bundle had been threshed separately, the average weight of grain per plant and per spike was computed for each group. In calculating the loss in yield for each collection from a field, use was made of the following formula: percentage loss in yield $= 100 - \left(\frac{W}{W_1 \times N} \times 100\right)$, where W is the total weight of grain from a collection, W_1 the average weight of grain from individual healthy plants, and N the total number of plants in a collection.

The tabulated data for the three years, 1939 to 1941, indicate a considerable variation in the percentage of diseased plants between soil zones or even possibly a greater one between different years. The percentage reduction in yield was not very closely related to the percentage of diseased plants in any one year, but there was relatively close agreement in this respect when the data for the whole three-year period or for all the zones were averaged. The average percentage of diseased plants and average reduction in yield for the three years was 38·3 and 12·1 per cent., respectively. An average for the three years showed that a slight attack by common root rot reduced the yield per plant by 25·7 per cent., a moderate one by 37·5, and a severe one by 53·3 per cent. About two-thirds of the total percentage of diseased plants in any one year or area showed slight root rot, and consequently most loss occurred in this class of plants. The reduction in yield is stated to arise chiefly from a reduction in the number of fruiting tillers and of kernels per spike. Discussing possible other factors influencing yield, the author points out that competition from weeds would probably cancel out any improved nutritional conditions afforded the healthy plants by the presence of diseased ones and at the same time exert a detrimental effect on diseased plants themselves, thus causing further reduction in yield. As in Manitoba the percentage of weedy fields is large, it is considered that the estimates of loss from common root rot given in this paper are not too high.

Stanton (T. R.) & Coffman (F. A.). **Grow disease-resistant Oats.**—*Fmrs' Bull. U.S. Dep. Agric.* 1941, 13 pp., 8 figs., 1 diag., 1943.

A number of new disease-resistant oats varieties have been developed, tested, and distributed for growing in the north-central states by State Agricultural Experiment Stations in co-operation with the United States Department of Agriculture [*R.A.M.*, xxii, p. 299]. The new varieties, outstanding among which are Boone, Marion, Control, Tama, Vicland, Cedar, and Vikota, combine high resistance to rusts [*Puccinia coronata* and *P. graminis*] and smuts [*Ustilago kolleri* and *U. avenae*] with high productiveness and desirable grain characters.

In Wisconsin, during the 1941 season in which crown rust [*P. coronata*] was very destructive, the average farm yield of the new variety Vicland [ibid., xxi, p. 441] was 69 bush. per acre as compared with 41·5 bush. for the standard varieties; in 1942 Vicland gave yields of 120 bush. per acre.

In Iowa damage to the oats crop caused by the severe crown rust epidemics of 1938 and 1941 was exceedingly heavy. During these two years the new varieties Boone, Tama, and Marion gave 60 bush. per acre as against 32 bush. yielded by the old varieties Richland and Gopher; the same two groups of varieties yielded 71 and 65 bush., respectively, in the years 1939, 1940, and 1942, when there was little or no crown rust.

Stanton (T. R.) & Coffman (F. A.). **Disease-resistant and hardy Oats for the South.**—*Fmrs' Bull. U.S. Dep. Agric.* 1943, 10 pp., 3 figs., 1943.

Attacks by crown and stem rusts [*Puccinia coronata* and *P. graminis*] and smuts [*Ustilago kolleri* and *U. avenae*] and by winter-killing are stated to have been the limiting factors in winter oats production in the southern states. In recent years new crown rust- and smut-resistant varieties, namely De Soto, Lega, Lelina, Letoria, and Stanton, which are as winter-hardy as the common varieties, have been developed and distributed to growers [cf. preceding abstract]. All these varieties originated from a cross between Lee and Victoria, made at Arlington Farm, Virginia, in 1931. Letoria is the most hardy of the five, with Stanton ranking second.

New red oats varieties resistant to crown rust and smut are Fulgrain (Strain 4), Victorgrain, Fultex, Ranger, Rustler, Quincy 1 and 2 [*R.A.M.*, xxii, p. 383], and Camellia, all originating from crosses between either Victoria or Bond and some standard local variety.

It is considered imperative in the South to treat all winter oat seed with new improved ceresan or other standard fungicide for the control of the smuts, root rots, and seedling blights. The use of certified seed is strongly recommended.

Gallagher (P. H.) & Walsh (T.). **The influence of manganese on the growth of cereals.**—*Proc. R. Irish Acad.*, Sect. B, xlix, 11, pp. 187–200, 2 pl., 1943.

Wheat in the Dublin district was affected in 1942 by manganese deficiency manifested, as in the case of a similar trouble of oats [*R.A.M.*, xx, p. 458], by the formation of grey, elongated specks on the leaves, sometimes covering the entire surface and causing apical withering. In one of the diseased crops, consisting of the Atle and April Red varieties, the former suffered much heavier damage than the latter. In a test to determine the effect of 1 per cent. manganese sulphate on the health of the plants, the grain yields of four sprayed plots amounted to 1·90, 1·42, 2·17, and 1·25 kg., respectively, compared with 0·88, 0·58, 1·16, and 0·55 kg., respectively, for the untreated controls.

The first symptom of the shortage in barley is a localized paling of the leaf, which soon develops into a number of small, oblong, grey spots with brownish margins; these in turn gradually enlarge and coalesce to form streaks parallel to the veins. The lesions tend to concentrate near the leaf tip, which becomes shrivelled. Affected rye plants show reduced vigour coincident with the production of whitish spots on the leaves, some of which bend over in the manner typical of grey speck of oats. In addition to the oats varieties already tested for their reaction to manganese deficiency [loc. cit.], a number of others were included in a new series of pot experiments, in which Potato (Ardee) and *Avena strigosa* proved to be virtually immune, Glasnevin Success 10, Victory II, Ardri, Sonas Potato 7, and Star sustained moderate damage, while Glasnevin Sonas, Failte, *A. fatua*, *A. nuda*, Wexford Tawny, and Early Miller were subject to increasingly severe attack in the order named; Victory II-Argentine shows acute symptoms in the early part of the season, but later makes a good natural recovery.

The Desprez was the most susceptible of the winter wheats to manganese deficiency in the early stages of growth, followed by Pajbjerg, Yeoman-Ironmaster, Queen Wilhelmina, and Squarehead Master, in the order named, but after mid-June, the first-named variety made a better renewal of growth than the two following. Atle was the most sensitive of the spring wheats to an inadequate manganese supply, and Red Fife the least so, Diamant, Kolbin, Red Marvel, and April Red occupying intermediate positions in the order named.

Maya was the most noticeably affected barley variety, followed in descending order by Kenia, Spratt-Archer, July Six-Rowed, Binder, and Old Irish, but the

growth of this crop was not materially impaired by a shortage of manganese, and the application of the sulphate did not therefore exert any very significant influence on the final yield. Similar observations apply in the case of rye, of which only the ordinary Irish seed was available for trials.

As already indicated by the outcome of previous investigations [loc. cit.], none of the various soil treatments applied against manganese deficiency exerted a permanently curative effect. Oats grown on manganese-deficient soil showed a marked diminution in the manganese content of the grain, but no correlation was apparent between that and varietal susceptibility. The use of immune varieties furnishes the most practical method of control on soils deficient in manganese.

MacLachlan (J. D.). **Manganese deficiency in soils and crops II. The use of various compounds to control manganese deficiency in Oats.**—*Sci. Agric.*, xxiv, 2, pp. 86–94, 1 fig., 1943.

In further studies of manganese deficiency in soils and crops in Ontario [*R.A.M.*, xxi, p. 193] during 1942 very heavy soil applications of compounds containing manganese sulphate were required to correct the deficiency in Erban oats grown on land where oats normally exhibited severe deficiency symptoms. The addition of sulphur at the rate of 1,000 lb. per acre increased the yield materially and in one instance reduced the amount of manganese necessary by about two-thirds. In comparative spraying tests a single 2 per cent. spray of manganese sulphate or of tecmangam (a commercial fertilizer containing 67 per cent. manganese sulphate) with a spreader and sticker gave the highest yield, though not as high as heavy soil applications. The spray caused some leaf-burning. Dusting with manganese sulphate and tecmangam without a diluent gave rise to severe injury. Three manganese ores, applied to the soil at the rate of 250 lb. per acre or as foliage dust equivalent in manganese content to a 1 per cent. manganese sulphate spray, gave little or no response.

When soil applications of tecmangam at rates ranging from 68 to 619 lb. per acre were made on a large muck field where oats normally express mild to moderate symptoms of manganese deficiency, both the yield and manganese content of the powdered grass from the first cutting (made just prior to jointing) indicated a response directly proportional to the amount of the compound added; the checks showed at the time of cutting mild symptoms. At the second cutting, 17 days later, there were no symptoms of manganese deficiency on the checks; the manganese content of the powdered grass made after this cutting indicated a response to the treatment, but there was no definite correlation with regard to yield.

In an addendum it is stated that Erban oats sown in 1943 on the entire range of manganese-deficient as well as adjoining normal soil at the Ontario Agricultural College showed no response to the heavy soil applications of manganese sulphate, either with or without sulphur, of the previous year.

Johns (D. M.) & Brown (H. B.). **Effect of date of planting on Corn yields, insect infestation, and fungous diseases.**—*Bull. La agric. Exp. Sta.* 327, 28 pp., 8 figs., 1941. [Received December, 1943.]

From 1933 to 1937, inclusive, an experiment was conducted on Mississippi alluvial soil at Baton Rouge, Louisiana, to determine the effect of planting date on maize yields, insect infestation, and four diseases, namely brown spot (*Physoderma zeae-maydis*) [*P. zeae*], smut (*Ustilago zeae*), dry rot (*Diplodia zeae* and *D. macrospora*), and rust (*Puccinia sorghi*) [*P. maydis*] (yield data only were obtained in 1933).

The difference in yield was probably not significant in plantings made between 25th February and 15th May, but there was a consistent falling-off in those of June and July, which were mostly characterized by an increased rate of growth

and development. *Physoderma zeae* was most severe in the planting of 15th May (average infection 27·5 per cent.), the ranges for the five earlier and three later plantings being 17·7 to 22·3 and 1·9 to 8·9 per cent., respectively. *D. zeae* was little in evidence in the 25th February and 12th and 28th March plantings (4·1, 3·4, and 3·8 per cent., respectively), but rose to 6·3 per cent. for those of 12th and 28th April, while the figures for 15th May, 1st and 15th June, and 3rd July were 6·4, 14·1, 10·7, and 9·6 per cent., respectively. The early spring plantings were virtually free from rust (traces only until 28th April, when 1 per cent. was reached, followed by 2·9, 4·8, and 5·8 per cent. for 1st and 15th June and 3rd July, respectively). Rust is likewise of negligible importance in early and mid-season plantings, but may be responsible for heavy damage in later ones, reflected in a sharp decrease in yield (average of five years for 15th June and 3rd July 20·2 and 10 bush. per acre, respectively), compared with 50·9, 48·6, 47·7, 46, 45·8, 44·8, and 34·5 bush. per acre for the plantings of 28th March, 25th February, 12th March, 28th April, 12th April, 15th May, and 1st June, respectively.

Jones (D. B.), Fraps (G. S.), Thomas (B. H.), & Zeleny (I.). **The effect of storage of grains on their nutritive value.**—*Reprint Circ. Ser., Nat. Res. Coun., Wash.*, 116, 14 pp., 1943.

This report (the seventh of the Committee on Animal Nutrition of the National Research Council of the United States) contains the following item of phytopathological interest. Swine were fed with maize that had become mouldy during storage in steel bins [cf. *R.A.M.*, xxii, p. 444] at the University of Illinois and their development compared with that of another lot receiving sound food. The following conclusion is quoted from the mimeographed report by B. W. Fairbanks, H. H. Mitchell, and M. D. Farrar (Extension Service in Agriculture and Home Economics, 1940)—'From the feed eaten for the production of 100 pounds of gain, it may be calculated that 1 ton of this sample of moldy corn had a feed replacement value equal to 1,667 pounds of corn minus 152 pounds of protein supplement. If sound corn is worth 56 cents a bushel or $20.00 per ton and the protein supplement is worth $40.00 per ton, the value of moldy corn is $13.63 per ton. At present feed prices the moldy corn was worth 68 per cent. the value of sound corn. In this connection we must not lose sight of the fact that the rate of gain is lower with moldy corn, and this results in a later marketing date.'

Hopkins (J. C. F.). **More information about the enemy of Maize: Diplodia.**—Reprinted from *Vuka, 1943*,, September–October, 2 pp., 1943.

Infection of maize by *Diplodia* [*zeae, Gibberella zeae*, and other species] is general throughout Southern Rhodesia [cf. *R.A.M.*, viii, p. 485], and also widespread in Northern Rhodesia and present in Nyasaland. Most probably, the disease has been introduced to all maize-growing countries on seed.

The chief predisposing factor is rainfall, the periodicity of which is of great importance. If the wet weather ends (in Southern Rhodesia) in February or March, the fungi become unable to penetrate the cob, or if they do so, cannot set up any extensive rot. As infection is often found when the cobs are reaped, although the crop appeared clean when stooked, some growers believe that infection spreads from cob to cob in the stooks, whereas more probably it results from spores deposited throughout the crop. If the moisture content of the grain is considerable, extensive rotting may occur before harvest. Even if the grain is not decayed, the fungus appears able to grow down the core and infect the grain. If, however, the cobs are left on the stalks, without stooking, they dry out more rapidly, and infection is checked; in seasons of late rainfall, indeed, it is questionable whether stooking is advisable.

In cold, wet weather seedling blight becomes rife, and a poor stand results. Soil

infertility also favours infection. A combination of adverse soil and climatic conditions renders many plants susceptible, while infection is sometimes correlated with mineral deficiencies. Some affected plants appear to show potash deficiency, and it would seem that either the fungus renders them unable to absorb the mineral, or that it easily attacks plants so affected. The author and Rattray have ascertained that some strains of maize are much more susceptible to potash deficiency than others.

Control depends principally on rotation and keeping up soil fertility, destroying infected residue, and seed selection and disinfection. None of the various fungi which in Southern Rhodesia are associated with the disease can pass in a living condition through the digestive tract of cattle; manure from animals fed on maize is not a source of infection. On the other hand, these fungi can, to a certain extent, withstand composting up to two turns. The amount surviving in the main bulk of the compost would probably have a negligible effect, but a concentration of mouldy cores and grain in one heap might, when applied to maize lands, result in appreciable soil infection. Infected wastes should be destroyed.

The black coating on old mealie stalks left beside a piece of land was found to consist almost entirely of living *Diplodia* spores. In the same way, infected cobs left in the lands become covered with spores of different fungi, and are poisonous to cattle. When whole cobs are found to be diseased, they should always be destroyed.

GRODSINSKY (L.). **La podredumbre seca de la espiga del Maiz.** [The dry rot of the Maize ear.]—*Publ. misc. Minist. Agric., B. Aires*, 112, 4 pp., 1 col. pl., 1942.

Of recent years maize crops in Argentina have sustained increasing damage from dry rot, associated with two fungi, *Diplodia zeae* and *Fusarium moniliforme* [*Gibberella fujikuroi*], which may occur singly or together. Pending the development of resistant varieties, control should be based on the destruction of diseased material at harvest time and the use of seed from healthy ears, which should be dusted before sowing with an approved fungicide.

MELCHERS (L. E.) & LOWE (A. E.). **The development of Sorghums resistant to Milo disease.**—*Tech. Bull. Kans. agric. Exp. Sta.* 55, 24 pp., 9 figs., 1 map, 1943.

Milo disease of sorghum, the preferred name for the disease formerly known under the names crown, shoot, and root rot of milo, or *Pythium* root rot, commonly attributed to *P. arrhenomanes* but now thought to be due to a complex of factors [*R.A.M.*, xxi, p. 523], was first reported in Kansas in 1926 and is now widely distributed in the western half of the State, as well as in Texas, where it is even more serious, Oklahoma, New Mexico, Colorado, and California.

The symptoms of the disease [which are briefly described] are liable to confusion with chinch bug [*Blissus leucopterus*], drought, or alkali injury. Milo, darso, and certain milo hybrids are susceptible, while all other sorghums and Sudan grass are resistant. In tests of the most widely grown sorghums 27 varieties of forage, 50 of grain, 3 of grass, and 6 of broomcorn are listed as resistant to the disease, and 11 of grain sorghum as susceptible. Early in the investigations it was found that resistant selections could be isolated from bulk seed of standard milo varieties. The resistance of field selections was determined in a greenhouse seedling test in infected soil, which was also used for selecting resistant strains from the standard susceptible varieties. In the latter case the tested selections were then grown in the field in comparison with the standard varieties from which they came, and their yield, type, and other agronomic characters evaluated. The fact that resistant lines occur in the field and may be readily isolated from all milo varieties and many milo hybrids is of great importance to sorghum production. It may be explained by the tendency to natural hybridization in the field, very common in

sorghums, or it may be due to recurring mutation giving rise to resistant lines; the full explanation of this genetic problem is as yet unknown.

Two milo disease-resistant varieties, Finney (a selection of Dwarf Yellow milo [ibid., xvi, p. 33]) and Westland (either a natural hybrid or a selection of Wheatland) have been distributed by the Kansas Agricultural Experiment Station. On fully irrigated land so heavily infested with milo disease that Dwarf Yellow milo and Wheatland were complete failures, Finney and Westland produced excellent yields (three-year averages of 59 and from 47·2 to 70·4 bush. per acre, respectively). In four-year trials on non-irrigated land fallowed one year before seeding, Dwarf Yellow milo and Finney produced almost identical yields, except that in 1941, when the milo disease was very severe, the yield of Finney was considerably larger; the yields of Westland were heavier than those of Wheatland in all years, but particularly so in 1941. Several other resistant lines of Yellow Dwarf milo and Wheatland have been isolated, and numerous resistant selections are available of Colby, Day, Beaver, Darso, Sooner, Pygmy, and Quadroon.

Finney and Westland have been approved for certification by the Kansas Crop Improvement Association. When these varieties are grown for certified seed, it is imperative to check their disease reaction in infested soil in the greenhouse during the early autumn, since the crop may have been grown in infested soil. Two rows from seed of a field for certification are therefore tested against two rows of a susceptible crop and certification depends on the results of this test. When a field is suspected of carrying milo disease, farmers are advised to send in a 5 lb. composite soil sample to be tested by the seedling test, as even a trace of infection can be detected by this method, thus indicating whether it will be necessary to grow a resistant variety or not.

LEUKEL (R. W.) & MARTIN (J. H.). **Seed rot and seedling blight of Sorghum.**—*Tech. Bull. U.S. Dep. Agric.* 839, 26 pp., 1943.

Seed-borne and soil-inhabiting fungi, combined with adverse environmental conditions, have been found to be largely responsible for poor germination and emergence of sorghum, an important war-emergency crop. The examination of 23 lots of seed from Oklahoma, Texas, and Virginia showed that the spores of *Alternaria* spp. predominated, followed by *Fusarium*, while *Penicillium*, *Aspergillus*, *Rhizopus*, and *Trichoderma* were also present in abundance, and *Sphacelotheca* and *Helminthosporium* occasionally. Virulent strains of *F. moniliforme* [*Gibberella fujikuroi*] and *P. oxalicum* were isolated from diseased seedlings grown in sterilized soils. *G. fujikuroi*, *P. oxalicum*, *R. tritici*, *R. nigricans* [*R. stolonifer*], and *A. niger* used as inoculum sometimes reduced emergence and caused subsequent seedling blight, especially at 15° and 20° C. *Alternaria* did not appear to be pathogenic, apart from blackening the seeds. In general, however, soil-inhabiting organisms, especially *Pythium* spp., caused heavier reductions of stand than did the seed-borne fungi, frequently attacking the young plumule and thus completely inhibiting emergence, or destroying the mesocotyl, seminal root, and subcrown rootlets before the crown roots developed. Species of *Fusarium* from the soil were much less injurious than *Pythium*, while the pathogenicity of *Penicillium*, *Rhizopus*, and *Aspergillus* varied with the amount of inoculum, the health of the seed, and the environmental conditions after planting.

Seed-coat injuries, which are very common in threshed sorghum, were found to promote the ready access of fungi to the endosperm, *G. fujikuroi* and *P. oxalicum* being exceptionally active in this respect. At 25° the emergence from sound seeds inoculated with these two fungi, *A. niger*, *A. flavus*, *F. culmorum*, *P. expansum*, and *Sclerotium bataticola* [*Macrophomina phaseoli*] ranged from 4·3 to 47·8 per cent. less than from comparable uninoculated seeds, the corresponding reduction for inoculated damaged seeds being from 8·3 to 69·4 per cent. At 20° the reduc-

tions for the inoculated lots ranged from 0 to 85 per cent. for the healthy and 59·5 to 100 for the injured seeds.

Dusting Spur feterita seed with copper carbonate [see next abstract] improved emergence in all the tests except one and reduced the percentage of subsequent seedling blight in the inoculated series in 12 out of 14 cases at 25° and in 10 out of 13 at 20°.

Leukel (R. W.). **Chemical seed treatments for the control of certain diseases of Sorghum.**—*Tech. Bull. U.S. Dep. Agric.* 849, 24 pp., 2 figs., 1943.

Trials have been in progress at the Arlington (Virginia) Experiment Farm since 1937 on the control of seed- and soil-borne diseases of sorghum by chemical seed treatments. In general, the application of fungicidal dusts resulted in a considerable improvement in emergence as compared with the controls, chiefly through the elimination of fungi already present in the soil (*Pythium* and *Fusarium* spp.). For instance, in 1937 the percentage of emergence of seed dusted with ceresan and sown in sterilized soil at 20° C. inoculated with *P.* spp. was 42 compared with 11 for the untreated, while barbak 111, merko, new improved semesan jr., ceresan, new improved ceresan, and cuprous oxide raised the emergence figures in soil inoculated with *F.* spp. from 21 to 96, 95, 87, 85, 80, and 80 per cent., respectively. As a rule, the absolute increase in emergence from treated seed reached a maximum at 20°, whereas the relative improvement was greatest at 15°, and least at 25°. Thus, in soil infested with *F. culmorum*, *Gibberella fujikuroi*, *Penicillium oxalicum*, *Rhizoctonia* [*Corticium*] *solani*, *Sclerotium bataticola* [*Macrophomina phaseoli*], *Pythium de Baryanum*, and *P. arrhenomanes*, the average emergence percentages of feterita seed at 15°, 20°, and 25° were as follows: untreated 6·4, 22, and 51·6, respectively; new improved ceresan 25, 48·6, and 73, respectively; copper carbonate 20·9, 42·1, and 70, respectively; cuprous oxide 20, 44·1, and 71·1, respectively; and sulphur 4, 25·6, and 47, respectively.

Discrepancies in the results of treatment at the recommended and heavier rates of dust application are attributed to differences in the variety of sorghum used, temperature, moisture, and extent of soil infestation. In cold soils severely infested by virulent pathogens the use of dosages at least twice as heavy as the prescribed rate is advocated.

Failure to achieve satisfactory control of kernel smut (*Sphacelotheca sorghi* and *S. cruenta*) in 1937 and 1938 with dusts applied at the rates of 2 to 3 oz. per bush. may have been due to an insufficiency of fungicidal material to inactivate all the seed-borne spores under the apparently ideal conditions for the parasites prevailing during the emergence period. In 1939, 1940, and 1941, the experimental results were better. For example, in 1939 new improved ceresan (½ oz. per bush.), copper carbonate, basic copper sulphate, cuprous oxide and sulphur (all at excess rates) reduced the incidence of infection in Sharon kafir from 14·3, 18·1, and 15·3 per cent. for spore dosages of 1 in 100, 1 in 300, and 1 in 600, respectively, to nil, merko permitting a trace of infection at the 1 in 600 rate only. Infection in Scarborough broomcorn was similarly reduced to nil by all the chemicals except merko and in Leoti sorgo a similar result was obtained, except that merko gave complete control of the weakest spore dosage while permitting traces of infection in the other two.

Chlorine gas [*R.A.M.*, xix p. 75] and sodium hypochlorite and formaldehyde solutions effectively combated smut, but their use is not recommended on account of inconvenience of application, cost, or seed injury. In connexion with the last-named factor, the deleterious effects of new improved ceresan appear to depend more on variety and dosage than on length of storage after treatment. Thus, when Leoti seed was planted one month after treatment at ½, 1, and 1½ oz. per bush., emergence was reduced by 5·3, 26·7, and 30·7 per cent., respectively, and 11·7, 23·6, and 36·5 per cent., respectively, of the seedlings showed mercury injury.

In Sharon kafir, on the other hand, emergence was not decreased and only 1·1, 1·8, and 5 per cent. of the seedlings were damaged by the treatments. In two separate tests in Maryland and Kansas in 1941 spergon gave absolute control of smut (checks 55 in the former and 37 in the latter location) in feterita and kafir and greatly improved emergence without injury to the seed.

The presence of glumes on the seed was found to impair the thoroughness of smut control by the new volatile dusts.

Planting smutted seed in soils with moisture contents adjusted to 30, 50, and 70 per cent. of saturation resulted in 26·8, 81·6, and 5·6 per cent. infection, respectively.

Huelin (F. E.). **The handling and storage of Australian Oranges, Mandarins, and Grapefruit.**—*Bull. Coun. sci. industr. Res. Aust.* 154, 60 pp., 3 pl., 2 graphs, 1942. [Photo-lithographed.]

This is a comprehensive, fully tabulated survey and discussion of the results of investigations by the Citrus Preservation Technical Committee from 1935 to 1941 on various problems concerned with the Australian export trade in Washington Navel, Valencia, Joppa, Parramatta, and Siletta oranges, Emperor mandarins, and Marsh Seedless grapefruit, special attention having been paid to the two first-named orange varieties.

Of major importance among the agents of wastage are the green and blue moulds (*Penicillium digitatum* and *P. italicum*), the main avenue of infection by which under present conditions of export is wounding. This should be avoided by clipping the oranges from the trees and careful handling during sweating, processing, grading, and packing. Dipping in borax has proved effective against the moulds, but solutions above 1 per cent. tend to increase 'wilting'. Preliminary tests with shirlan, diphenyl wraps, and nitrogen trichloride ('Decca' gas) also gave promising but not yet fully conclusive results.

Stem-end rot (*Diplodia natalensis* and *Phomopsis* [*Diaporthe*] *citri*) cannot be combated by any of the above-mentioned precautions, but require fungicidal treatment in the grove, and oranges infected at picking are almost certain to undergo extensive wasting during export, since the disease develops rapidly at atmospheric temperatures. At present, however, the bulk of the trade is confined to areas comparatively free from the agents of stem-end rot.

Besides the comparatively well-defined rind blemishes associated with *Phoma citricarpa*, *Septoria* spp., and an apparently functional disturbance known as 'glazed scab', consisting of dirty cream-coloured lesions with a hard, enamel-like surface, there remains a large group of imperfectly understood disorders, collectively termed 'storage spot' [*R.A.M.*, xx, p. 340], since most of the wastage from this source develops after a period of storage at 37° to 45° F. The contributors to the present report have been unable to draw sharp lines of demarcation between those types of spotting, which appear to include H. S. Fawcett's anthracnose spot, *Alternaria* spot, brown spot, and storage spot or pox [ibid., xv, p. 574]. On the other hand, it has been found helpful to separate the troubles into two classes, button and lateral spots, of which the former usually contain fungi, e.g., *A.* spp., *Colletotrichum gloeosporioides*, and *Fusarium* spp., while the latter are more frequently, though by no means invariably, sterile. Button spots are very prevalent and are apt to lead to subsequent rotting.

The interpretation of the data obtained in these investigations on storage spot presents some difficulty, since they appear to fit two entirely different conceptions of a complex disease, one functional and the other fungal. The fact that the incidence of the spotting generally declined with a rise in temperature from 40° to 55° is in keeping with a theory of cold injury, whereas its reduction by fungicidal treatments rather supports a hypothesis of microbial origin. In different lesions

the relative importance of the two factors may vary greatly, extreme cases being represented, on the one hand, by collapse and death of the rind tissue from purely functional causes, and on the other, by the fungal invasion of rind of naturally low resistance, inducing the formation of virtually identical spots: the latter form of the disorder has also been observed on non-stored fruit and that left hanging late on the tree. There are also many transitional types of storage spot, in which neither cold injury nor latent infection can be implicated as the sole agent, but an interaction of both factors probably takes place.

'Scald' is an extensive light brown, superficial discoloration developing at 34° to 37°. 'Gooseflesh', which is more prevalent at 32° to 34°, is characterized by pallor and depression of the tissue between the oil vesicles, often accompanied by an oily, disagreeable flavour and aroma: the affected areas are liable to rapid mould invasion on removal from storage. 'Skin bleach', which may assume a very serious form in cold-stored fruit, begins as a creamy, opaque discoloration of a considerable portion of the rind, the oil vesicles of which are darker than the surrounding tissue and stand out prominently. The affected area is somewhat soft and readily accessible to fungal invasion. The outer rind of mandarins suffering from 'crinkled collapse', a common cold-storage disorder, is pale, irregular, and crinkled, with dark, prominent oil glands. Finally, the skin darkens and the entire fruit collapses.

Since 1938 the Australian citrus export trade has been almost entirely restricted to New Zealand, and for this market the main consideration is the control of *Penicillium* rots by careful handling at all stages. Storage spot has hitherto been of negligible importance, and need not become troublesome if the oranges are 'sweated' (left loose in field boxes) for seven days after picking and not placed in cold storage until arrival at their destination. Non-refrigerated shipment is generally preferable, especially in the relatively cool Navel season. All 'sweat' boxes and every part of the processing and grading plant should be kept clean and smooth, while packing sheds should be regularly washed or sprayed with a fungicidal solution. To control 'wilting', oranges should be treated with a wax emulsion, to which not more than 1 per cent. borax may be added for mould elimination, as mentioned above. The 'hot fog' process, in which the fruit was sprayed with molten wax (90 per cent. paraffin, 10 per cent. carnauba) in a chamber heated to 150°, reduced the amount of wilting to about 45 per cent. of the control.

Speroni (H. A.). **Tizón gomoso de las ramitas de los Citrus.** [Gummy blight of Citrus shoots.]—*Publ. misc. Minist. Agric., B. Aires,* 114, 4 pp., 2 col. pl., 1942.

The form of gummosis described in this popular leaflet has been observed mainly in lemon groves in Argentina and is attributed to the agents of foot rot (*Phytophthora parasitica* and *P. citrophthora*) [*R.A.M.*, xxi, p. 195]. In September, 1938, the disease was found in the Paraná Delta to be affecting lemons grafted on trifoliate orange [*Poncirus trifoliata*] stocks, which are ordinarily resistant to this type of infection, but the insertion had been made unduly near soil-level (less than 10 cm. from the ground). The first symptoms of the trouble may pass almost unnoticed, consisting merely in a paling of the vivid green of the young shoots, followed by a slight swelling and exudation of a light amber-coloured gum; by this time the shoots have assumed a yellowish tinge, which finally turns a pale chestnut, imparting a scorched appearance to the affected parts. The fungi may, however, attack the fruits first, causing brown rot, and pass thence to the shoots, girdling and killing them under conditions favouring the pathogens, notably excessive atmospheric humidity and a moderate temperature (20° C.) without abrupt fluctuations. Control measures are indicated.

Sokoloff (V. P.) & Klotz (L. J.). **Decline and collapse of Citrus trees in relation to nitrite in orchard soils.**—*Calif. Citrogr.*, xxviii, 11, pp. 290, 308, 3 figs., 1943.

In continued studies on the decline and collapse of citrus trees [*R.A.M.*, xxii, p. 319] the association between failure of feeder roots and presence of nitrite in the root zone was further investigated. The addition of nitrite (equivalent to 40 p.p.m. nitrogen) to the soil caused the collapse of a vigorous Navel orange tree within a week. Root zones of collapsed lemon trees were frequently found to contain from 15 to 30 p.p.m. nitrogen as nitrite, and those of collapsed walnuts and apricots as much as 60 p.p.m. In the greenhouse similar concentrations of nitrite in water and in soil cultures proved toxic not only to citrus and avocado, but also to tomatoes, maize, peas, sugar and table beets, and other vegetables. Very small amounts of nitrite did not appear to cause appreciable injury to roots, but seemed to predispose them to infection by the brown rot fungi (*Phytophthora* spp.). In the absence of these fungi the roots usually recovered on removal to nitrite-free media. Grown in water cultures containing nitrite, sweet and sour orange, rough lemon, and a kumquat-mandarin hybrid were susceptible to the brown rot fungi, while grapefruit, shaddocks, and, under certain conditions, Sampson tangelo, were fairly resistant.

The nitrite is formed in soil from nitrate and organic matter in presence of excessive moisture, but not necessarily waterlogging. Accumulations of nitrite may also result from a delayed or inhibited oxidation of ammonia by bacterial action, in the normal process of which the ammonia is first oxidized to nitrite and then to nitrate. Small amounts of nitrate distributed in patches are capable of producing more nitrite than twice the same amounts spread evenly over the same area. In order to minimize the possibilities for the production of nitrite, it is recommended to withhold commercial nitrogen from the trees until the supply of soluble organic matter in the soil is at a minimum, especially during the periods of excessive moisture, and to distribute nitrogenous substances evenly and in small amounts several times a year so as to avoid local excesses as far as possible.

Cox (J. A.), Bobb (M. L.), & Hough (W. S.). **A fungous disease of the Comstock Mealybug.**—*J. econ. Ent.*, xxxvi, 4, pp. 580–583, 1 fig., 1 graph., 1943.

Following a rainy spell in August, 1940, a fungous disease destroyed from 40 to 50 per cent. of the Comstock mealybugs (*Pseudococcus comstocki*) in infested apple orchards in two localities of Virginia, and in the two succeeding summers it reappeared; by the autumn of 1942 the population of the insect in the two places visited by the pathogen had fallen to a very low level, presumably in consequence of the epidemic. [Vera K.] Charles and collaborators isolated the fungus in pure culture and concluded that it was a new species (abs. in *Phytopathology*, xxxi, p. 5, 1941), for which J. G. Harrar and J. J. McKelvey proposed the name of *Endosclerotium pseudococcia* [nomen nudum] (abs. in ibid., xxxii, p. 7, 1942). It has since been learnt, however, through correspondence with the Bureau of Plant Industry, Division of Mycology and Plant Disease, that the fungus under observation closely resembles the *Isaria* stage of *Cordyceps clavulata*, collected on the same insect on *Catalpa* trees in 1923 (*Tech. Bull. Va agric. Exp. Sta.* 29, 1925), but its exact identity of which is still in doubt.

Fitzgerald (L. R.). **Phoma stenobothri, a fungus parasite of the Grasshopper.**—*Amer. Midl. Nat.*, xxix, 3, pp. 761–767, 1 pl., 6 figs., 1943.

The presence of a fungus causing the death of grasshoppers (*Melanoplus differentialis*) was detected in the blood and muscles of specimens of the host from a colony maintained at the Zoology Department of the State University of Iowa in 1940. The pathogenicity of the organism, which produces no external changes in the grasshopper, even at the time of death, was established by artificial infection.

Histological examination showed that the only tissues to be attacked before death are the blood and muscles. The fungus cells [? spores] first appear in the haemolymph but are found in the haemocytes shortly after, and in the later stages of the disease all the haemocytes contain cells, often being so packed that the blood cell membrane is greatly stretched. The muscle fibres of infected animals become separated from each other, as do also the fibrillae, the striations disappear, and complete breakdown follows. The fungus forms in culture subspherical, subcarbonous pycnidia, 150 μ in diameter, and bluntly ovoid, hyaline, extremely refractive conidia, pinkish in the mass, 4 to 5 by 1·5 to 2·5 μ. The species is considered to be identical with *Isaria stenobothri* described by Hollande and Moreau (in *Arch. Zool. exp. gén.*, lxi, pp. 59–74, 1923), but in view of its characters is transferred to the genus *Phoma*, as *P. stenobothri* (Hollande & Moreau) comb. nov.

VARADA RAJAN (B. S.) & PATEL (J. S.). **Stem-rot disease of Jute.**—*Indian J. agric. Sci.*, xiii, 2, pp. 148–156, 2 pl., 1943.

Stem rot of jute (*Macrophomina phaseoli*) is stated to be widespread in Bengal [*R.A.M.*, xx, p. 167], and to have been reported also from Assam and Bihar and Orissa. The sclerotial and pycnospore dimensions of the authors' collections were found to agree with those of Haigh (C strain) [ibid., ix, p. 685] and Ashby, respectively [ibid., vi, p. 757]. The pycnidial stage of *M. phaseoli* constitutes an important source of virulent secondary infection, the spores readily invading the leaves, the rot of which spreads through the petiole to the node. The incidence of secondary infection is generally four times that of primary (74·6 as against 18·6 per cent. in a field of 150 D 154 plants in 1941). Infection of the stem is followed by shredding, canker, or wilting. The primary root rot usually occurs sporadically late in the season, or earlier if high temperatures prevail. Late attacks are responsible for seed contamination, which is believed to be a more prolific source of primary infection than the soil. The fungus is also perpetuated on jute stubble and such crops as linseed, sesame, and cowpeas, while it is further harboured by the common weed, *Cyperus distans*. The critical period for the crop, and the most favourable for stem rot, is before the age of eight weeks or after that of 4½ months.

CARRERA (C. J. M.). **La 'fusariosis' o marchitamiento del Lino en la República Argentina debida al 'Fusarium lini', Bolley.** [Flax 'fusariosis' or wilt in the Argentine Republic due to *Fusarium lini* Bolley.]—*Publ. misc. Minist. Agric., B. Aires*, 113, 4 pp., 1 col. pl., 1942.

The presence of flax wilt (*Fusarium lini*) was first established in Argentina in 1930, on the occasion of the visit of Professor H. L. Bolley of the University of North Dakota [*R.A.M.*, xi, p. 300]. The symptoms of the disease are briefly described and control measures recommended, the latter including the use of seed from the survivors of an epidemic, which may be credited with a high degree of resistance; a 7- to 11-year crop rotation; demarcation of foci of infection to avoid contamination of ploughs, harrows, and the like, which should be sterilized, if necessary, with a 2 to 3 per cent. formalin solution; burning of stubble, etc.; seed treatment with a mercury- or copper-containing fungicide or formalin (2 to 3 in 1,000); and shallow sowing at the earliest convenient date, while low temperatures still hold the development of the fungus in check.

EICHHORN (E.). **Beobachtungen an Farnrosten.** [Observations on Fern rusts.]—*Ber. bayer. bot. Ges.*, xxv, pp. 122–127, 1941. [Abs. in *Z. PflKrankh.*, liii, 4–7, p. 226, 1943.]

The distribution of 13 European fern rusts of the genera *Milesina*, *Hyalopsora*, and *Uredinopsis* is described. Species belonging to the two last-named genera cause a yellow discoloration of the fronds. *M.* spp. shun the light, especially *M. feurichii*

on *Asplenium germanicum* and *A. septentrionale,* which occur only in forest ravines.

GIGANTE (R.). **L''antracnosi' del Croton.** [Croton anthracnose.]—*Boll. Staz. Pat. veg. Roma,* N.S., xxi, pp. 57–100, 1941. [Abs. in *Z. PflKrankh.,* liii, 4–7, p. 233, 1943.]

Croton (*Codiaeum*) shrubs were attacked in Italy in 1939 by anthracnose (*Gloeosporium sorauerianum* Allesch.), which produced on the leaves circular or elliptical, brown spots with a reddish-brown halo, the petioles and median veins of the foliage being covered with oblong pustules surrounded by brown stripes. The centres of the spots on both leaf surfaces are occupied by numerous acervuli, from which arise hyaline conidia, 14 to 20 by 4 to 7 μ, borne on conidiophores 20 to 24 μ in length. The fungus grows readily on artificial media, especially those with an acid or neutral reaction, forming a profusion of conidia similar to those developing naturally on the host. The minimum, optimum, and maximum temperatures for the growth of the pathogen are 10°, 25°, and 40° C., respectively.

ULBRICH (E.). **Hexenbesen und Hexenbesen-Rost an Berberis vulgaris L. und über die Gattung Tuberculina Saccardo 1880.** [Witches' broom and witches' broom rust on *Berberis vulgaris* L. and the genus *Tuberculina* Saccardo 1880.]—*Notizbl. bot. Gart. Berl.,* xv, pp. 415–420, 1941. [Abs. in *Z. PflKrankh.,* liii, 4–7, p. 234, 1943.]

Besides the witches' broom produced on barberry by *Puccinia arrhenatheri* [*R.A.M.,* xx, p. 596], another form of the disorder exists attributable to mechanical friction of the branches. Numerous stations of the rust on barberry are listed. The aecidia of *P. arrhenatheri* are sometimes covered with the conspicuous pinkish-purple deposits of *Tuberculina persicina* [ibid., xix, p. 730], which was further observed on *Aecidium rhamni.* The taxonomy of the hyperparasite and its connexion with the rusts are discussed.

DRAYTON (F. L.) & GROVES (J. W.). **A new Sclerotinia causing a destructive disease of bulbs and legumes.**—*Mycologia,* xxxv, 5, pp. 517–528, 11 figs., 1943.

In 1931 a species of *Sclerotinia,* apparently identical with *S. minor* in culture, was isolated from completely rotted tulip bulbs, from Utica, New York, the sclerotia, up to 6 mm. in diameter, being densely packed beneath the tunic and between the scales. In 1935 apparently the same fungus was received from Edmonton, Alberta, where it had caused a destructive root rot of lucerne and sweet clover (*Melilotus* sp.); and from Westmount, Quebec, where it attacked tulips, 70 per cent. of the bulbs in one bed having either failed to grow or having produced only a few small leaves. Further isolates were received from rotted tulips from Montreal in 1936, from white and yellow sweet clover (*M. alba* and *M. officinalis*) from Edmonton in 1937, and from tulip and narcissus from another planting at Westmount in 1939.

Of 12 cultures studied apothecia were obtained from nine (four from tulips, one from narcissus, and four from sweet clover), and all the evidence indicated that the fungi obtained from the bulbs and from the legumes were identical. The fungus, which differed from *S. minor* in the darker colour of its apothecia, its smaller asci and ascospores, and the different conditions required for the production of apothecia, also differed from *S. intermedia,* which showed a more abundant aerial mycelium, fewer and fleshier sclerotia, and longer, narrower asci and ascospores. It is named *S. sativa* n.sp. The 8-spored, cylindrical asci have a slender, tapering stalk, and measure 100 to 120 to (130) by (7·5) to 8 to 10 μ; the ellipsoid to ovoid, hyaline, one-celled, uniseriate ascospores measure 9 to 11 to (12) by 4 to 5 to (7) μ.

Inoculation experiments at Edmonton showed that the isolate from the Utica

tulips was highly pathogenic on the roots of lucerne and sweet clover. Later, four further isolates from tulips were found to be strongly pathogenic to both lucerne and sweet clover. The Edmonton isolates from the legume hosts were consistently more pathogenic to sweet clover than to lucerne, while the tulip isolates from Utica attacked both hosts with equal severity. In a third trial the Utica tulip isolate and a sweet clover isolate were used to inoculate bulbs of six tulip varieties. The results showed that the Utica tulip isolate completely rotted all the bulbs of all the varieties, except one bulb of Prince of Austria, which was partially rotted, and from which weak growth had started. The sweet clover isolate produced similar symptoms to those of the tulip isolate, except that it gave more partially rotted bulbs. With both cultures the completely rotted bulbs were pulpy and had concentric rings of sclerotia packed between the scales. In the partially rotted bulbs most of the decay was at the base or between the outer scales and the growth of the shoot was much retarded. The evidence obtained also demonstrated that the fungus required the low temperatures of the soil experienced at Edmonton during late autumn, winter, and early spring for its pathogenic activity.

In efforts to obtain apothecia in November, 1938, tulip and legume isolates were transferred to wheat plates, and for two months half were incubated at 14° C. and half at 5°. Only individual sclerotia were used on the sand in the preparation dishes, and they were placed at 0° for a month, followed by two weeks at 5° after spermatization, then two weeks at 14°, after which they were transferred to the greenhouse. In June, 1939, the cultures were placed at 0°, and in November they were returned to the greenhouse. On 7th March, 1940, a mature apothecium was observed, and apothecia continued to develop until May.

To ascertain the sexual behaviour of the fungus eight single ascospore cultures from both tulip and legume isolates were grown on wheat at 5° and 14° for three months, and individual sclerotia were then put on moist sand at 0° for two months. One set remained unspermatized, two sets were spermatized with spermatia from single ascospore cultures from tulip isolates, and two were spermatized with spermatia from single ascospore cultures from sweet clover isolates. Apothecia appeared in both spermatized and unspermatized dishes, showing conclusively that the fungus was homothallic and self-fertile.

Smith (O. F.). **Rhizoctonia root canker of Alfalfa (Medicago sativa).**—*Phytopathology*, xxxiii, 11, pp. 1081–1085, 1 fig., 1943.

The fungus isolated from cankered lucerne roots in southern California and south-western Arizona was identified by J. E. Kotila as *Rhizoctonia* [*Corticium*] *solani*, the circular or oblong, sunken, sometimes brown-bordered lesions caused by which usually develop at the point of emergence of a young root from a larger one. The central region of the root may be partially involved in the decay, but there is very little spread of infection upwards or downwards from the site of entry. The pathogen is favoured by the high soil temperatures (21° to 35° C.) prevailing locally from June to September, its activity being suspended during the winter months at a range of 5° to 10°. Lesions formed during the summer usually heal over by mid-winter or early spring, when there is often only a scar on the root to mark the position of the previous season's attack. Under controlled conditions the disease assumed a severe form on roots grown at a soil temperature of 25° to 30°, but was practically absent from those maintained at 16° to 18°. Positive results were given by soil inoculation experiments with barley grain cultures of *C. solani* at the higher temperature range, and there is considered to be no doubt that the fungus is the cause of the root canker which contributes materially to the heavy losses incurred of recent years by growers in and near the Yuma Reclamation Project.

SCRIPTURE (P. N.) & MCHARGUE (J. S.). **Effect of boron deficiency on the soluble nitrogen and carbohydrate content of Alfalfa.**—*J. Amer. Soc. Agron.*, xxxv, 11, pp. 988–992, 1943.

In a greenhouse at the Kentucky Agricultural Experiment Station Grimm lucerne was grown in purified sand cultures, boron being omitted from the synthetic nutrient solution in five of the ten pots after the seedlings reached 5 in. in height. Extracts of the plant tissue were obtained by Chibnall's method with the aid of a Carver press (*J. biol. Chem.*, lv, pp. 333–342, 1923) and analysed for nitrogenous constituents and reducing sugars. Soluble nitrogen compounds, including amides, ammonia, and nitrogen in other forms, were found to be present in higher proportions in the boron-deficient plants, with their slightly roughened and thickened yellow or yellow-bronze leaves, and suppressed terminal buds [*R.A.M.*, xxi, p. 494], than in those making normal growth. The affected plants also contained an excess of sugars. The possibility of a connexion between boron and the protein metabolism of plants is suggested on the basis of these observations.

RICHTER (H.). **Lupinenfusariosen.** [Lupin fusarioses.]—*Mitt. biol. Anst. (Reichsanst.), Berl.*, 64, pp. 50–61, 1941. [Abs. in *Z. PflKrankh.*, liii, 4–7, p. 236, 1943.]

Yellow lupin (*Lupinus luteus*) wilt (*Fusarium oxysporum*) endangers the cultivation of the crop in infested areas in Germany [*R.A.M.*, xviii, p. 832], where the fungus is disseminated mainly by means of diseased plant refuse, as well as through the seed. In inoculation experiments the isolates from yellow lupin were pathogenic only to their own host. In some cases, however, the blue (*L. angustifolius*) and white (*L. albus*) lupins yielded wilt-inducing strains differing culturally from those attacking *L. luteus* and not always pathogenic to the last-named species in infection tests. The white lupin also suffers from a pod rot associated with a wound parasite, *F. avenaceum*, which was weakly parasitic on the other species in artificial inoculations.

KREITLOW (K. W.). **Ustilago striaeformis. II. Temperature as a factor influencing development of smutted plants of Poa pratensis L. and germination of fresh chlamydospores.**—*Phytopathology*, xxxiii, 11, pp. 1055–1063, 1 fig., 1943.

Poa pratensis plants infected by stripe smut (*Ustilago striaeformis*) [*R.A.M.*, xxiii, p. 21] were collected in 1941 and 1942 from some 75 pastures in Pennsylvania where high field and greenhouse temperatures were found to be unfavourable for their development. Some of the diseased plants lost the symptoms of infection after four months' continuous exposure to a temperature of 32° C., but regained them for the most part on transference to one of 20° to 25°. Chlamydospores removed from the leaves of diseased plants growing at 32° germinated to the extent of 90 per cent. without any after-ripening period, which was reduced, moreover, from 200 to under 30 days by the incubation of detached smutted leaves at 35° in a moist chamber. No germination took place, however, in the case of chlamydospores taken from plants growing at 1·5°, 10°, or 20° to 25°.

The examination of chlamydospores from over 300 smutted *P. pratensis* plants collected in 75 pastures failed to disclose the presence of physiologic races of *U. striaeformis* with germinable fresh spores.

WERNHAM (C. C.) & KIRBY (R. S.). **Prevention of turf diseases under war conditions.**—*Greenk. Reptr*, xi, 4, pp. 14–15, 26–27, 1943.

In Pennsylvania the principal turf diseases on greens [*R.A.M.*, xxii, p. 436], in order of importance, are large brown patch [*Rhizoctonia* spp., chiefly *Corticium solani*], small brown patch or dollar spot [*Sclerotinia homoeocarpa*], 'melting-out'

(*Helminthosporium*) [and *Colletotrichum*] spp., and on fairways bluegrass [*Poa*] leaf spot [? *Septoria poae*], 'melting-out', and snow mould (*Typhula*). A key for the recognition of these disorders is given.

Large brown patch is partially controllable by preventive measures, including the sparing use of inorganic nitrogenous fertilizers, watering in the morning to insure rapid drying at a rising temperature, and judicious pruning of trees and shrubs to provide air drainage. Where mercury compounds are available, a mixture of calomel [mercurous chloride] and mercuric chloride (2 : 1) is effective at a dosage of 1½ to 3 oz. per 1,000 sq. ft., the lower rate being preferable during hot weather. The fungicide may be mixed with sand and broadcast, or applied with a power sprayer. If mercury compounds are unobtainable, hydrated lime should be broadcast at the rate of 10 lb. per 1,000 sq. ft. at three-weekly intervals, the green being poled immediately after treatment and not washed for 24 hours. Dollar spot may also be effectively combated by the above-mentioned mercury mixture, or by thiosan at the rate of 5 oz. per 1,000 sq. ft.; the latter may further be substituted for lime in areas where both large and small brown patch are present, or where the use of lime is undesirable. *S. homoeocarpa* does not yield to indirect measures of control, but those recommended against large brown patch are similarly effective in the reduction of 'melting-out', which may also be treated with thiosan or lime. The 2 : 1 mercury mixture (2 oz. per 1,000 sq. ft.) gave the best control of snow mould in two years' experiments, while promising results were also obtained in one season with spergon (6 oz. per 1,000 sq. ft.).

Bluegrass leaf spot falls into two stages, one involving the foliage and the other the crown. The spots on the leaves are straw-coloured, necrotic, ¼ to ½ in. long; when the crowns are attacked all the leaf blades may appear dead and severed, leaving only a reddish-brown tuft. The latter form of the disease is most destructive on closely clipped turf, and may be held in check by setting the mower to cut 1½ to 2 in. high during the spring, and by spring or autumn applications of a fertilizer to strengthen the grass.

Copper spot, first observed in the summer of 1942 at State College, is characterized by irregular, coalescent, copper-coloured areas on the grass, differing in hue from the bleached straw of the otherwise similar dollar spot. When the leaves are wet with dew, pink or reddish, gelatinous fungal pustules, the size of a pin's head, may be observed. Work on control measures is in progress.

Brief notes are given on the blemishes caused by slime mould [*Mucilago spongiosa*: ibid., xiv, p. 766] and fairy rings, the former removable by washing the turf with a stream of water from a hose, while treatment of the latter is impracticable.

HEARN (J. L.). **Rhizoctonia solani Kühn and the brown patch disease of grass.**— *Proc. Tex. Acad. Sci.*, xxvi, pp. 41–42, 1943.

The discoloured (alternating light and dark brown) patches in grass caused by *Rhizoctonia* [*Corticium*] *solani* [see preceding abstract] may attain a diameter of more than 20 ft. in Texas, where the disease usually develops between September and January. In this typical form of brown patch the roots and stolons sustain no injury, but a spring and summer manifestation of the disease is accompanied by the death of the roots, followed by that of the stolons and leaves. The fungus occurs in soils with a P_H ranging from 6 to 8·2, with an optimum at 7, and is favoured by temperatures between 72° and 94° F., as well as by an excess of nitrogen, especially in the form of ammonium sulphate. Effective fungicides for use against brown patch include semesan, uspulun, corona 620, corona 640, germisan, mercuric oxide, mercuric cyanide, and mercurous chloride, nitrate, and sulphate, a formula of 2 oz. mercurous chloride and 1 oz. mercuric chloride in 8 pts. dry sand per 1,000 sq. ft. being widely used [loc. cit.]. Tetramethylthiuram disulphide, incorporated in Du Bay 1205 FF, thiurad, and tuads, has given satis-

factory results at 4 oz. per 1,000 sq. ft., while Bordeaux mixture may be useful in alkaline soils.

DENNIS (R. W. G.). **A black rot of Apples, new to Britain.**—*Gdnrs' Chron.*, Ser. 3, cxiv, 2972, p. 221, 2 figs. (1 on p. 223), 1943.

The fungus isolated at the Plant Pathological Laboratory, Department of Agriculture for Scotland, in September, 1942, from the rotten tissues, with coal-black centres and brown edges, of four apples from a Corstorphine (Edinburgh) garden was identified by Dr. G. R. Bisby as *Strasseria carpophila* Bres. & Sacc., first described on the same host from Lower Austria (*Verh. zool. bot. Ges., Wien*, lii, pp. 429–437, 1902). The Scottish material agrees in the main with the original diagnosis, except for the slightly smaller pycnospores (9 to 14 by 2 to 3 as compared with 13 to 17 by 3 to 4 μ) and shorter appendages (mostly 13, occasionally up to 20 μ in length as against 18 to 24 by 0·5 μ). Von Höhnel (Fragmente zur Mykologie, Mitteilung xviii, 1916) drew attention to some typical features of the fructifications in the Austrian collection, which consisted of a whitish crust under the host epidermis overlying a ring of dark tissue, composed of thin-walled cells 4 to 6 μ in diameter and measuring 170 μ across, 100 μ in thickness at the margin, but only 25 μ at the centre, where it is replaced by a core of hyaline cells breaking down to form the ostiole. The mature pycnidia are multilocular. These characters were clearly marked in the Edinburgh specimens.

S. carpophila is likely to be more frequent on diseased apples than might be gathered from the paucity of records in the relevant literature, being no doubt commonly overlooked owing to the delayed maturation of the pycnidia (commencing on 10th October in the writer's material) and the difficulty of detecting the appendage on any but ripe, naturally exuded spores. An entirely blackened apple received from Ross-shire in October, 1940, bore immature fruit bodies also probably belonging to *S. carpophila*, the isolation of which was prevented, however, by bacterial contamination. Apples infected by this type of rot turn black before picking, and are thus readily distinguishable from those invaded by *Sclerotinia fructigena* during storage. No inoculation experiments were carried out with *Strasseria carpophila*, but in the Edinburgh collection, at any rate, it appears to have developed as a sequel to primary infection by *Botrytis cinerea*, which was readily isolated from the brown marginal tissue of the lesions.

MOTE (D. C.) & OWENS (C. E.). **Insect pests and diseases of Currants and Gooseberries.**—*Circ. Ore. agric. Exp. Sta.* 152, 11 pp., 4 figs., 1943.

The most troublesome diseases of currants and gooseberries in Oregon are powdery mildew (*Sphaerotheca mors-uvae*) and leaf spot (*Pseudopeziza ribis*), while damage is also sometimes caused by die-back (*Plowrightia ribesia* and *Botrytis* sp.), mushroom root rot (*Armillaria mellea*), and weakening or killing of the plants due to high water table and defective drainage. Spraying schedules are given for the control of the insects and fungi listed, separately and in combination. Lime-sulphur is effective against powdery mildew alone, but should be replaced by Bordeaux mixture for the later applications where leaf spot is also present.

Statutory rules and orders, 1943, No. 1686. Destructive Insect and Pest Acts, England. The Sale of Diseased Plants (Amendment) Order of 1943. Dated December 6, 1943.—2 pp., 1943.

The present Amendment, which came into operation on 15th December, 1943, to the Sale of Diseased Plants Order of 1927 and its Amendment of 1936 [*R.A.M.*, xv, p. 464], revokes the Onion Smut Order of 1921 and brings onion and leek smut (*Urocystis cepulae*) under the two above-mentioned Orders, thereby retaining the essential control measure, i.e., the prohibition of sale for propagation of any onion or leek plants substantially affected by the smut.

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SMITH (C. O.) & COCHRAN (L. C.). **A noninfectious heritable leaf-spot and shot-hole disease of the Beaty Plum.**—*Phytopathology*, xxxiii, 11, pp. 1101–1103, 1 fig., 1943.

For a number of years past, Beaty plums (*Prunus angustifolia varians* × *P. munsoniana*) at the California Citrus Experiment Station have been affected by a leaf spot and shot hole macroscopically indistinguishable from that caused by *Coryneum beijerinckii* [*Clasterosporium carpophilum*], but apparently not of fungal origin, since cultures from the tissues were negative. None of the stocks of various *P.* spp. inoculated with buds from a severely diseased seedling developed the typical symptoms, which appeared after some time, however, on the initial leaves of shoots arising from the introduced material. Scions from the original parent Beaty plum, which had remained free from the trouble, were top-worked on to diseased seedlings, the leaves of which became riddled with holes, while the scion growth was normal. The non-transmissibility of the disorder precludes its inclusion in the virus group of diseases, and that it is a genetical abnormality that segregates among the progeny is regarded as the most likely explanation of its various features.

FISHER (D. V.), BRITTON (J. E.), & O'REILLY (H. J.). **Peach harvesting and storage investigations.**—*Sci. Agric.*, xxiv, 1, pp. 1–15, 3 figs., 1943.

Low temperature breakdown of peach as it occurs in the Okanagan Valley of British Columbia, where a rapid expansion of the peach-growing industry has taken place in recent years, varies somewhat according to the variety and the season. In the early varieties, such as Rochester and Vedette, the fruit tends to become dry, fibrous, and mealy, and in cross section shows a browned, flushed area around the periphery gradually extending inwards. After removal from store the fruit remains rather firm but finally becomes mushy. With late varieties, e.g., J. H. Hale and Elberta, the fruit is firm and attractive in appearance on removal from store but within a few days becomes soft and spongy, discoloured in the flesh, stringy and coarse in texture, and inedible.

In cold storage experiments conducted in 1940 and 1941 at the Summerland Experimental Station [full details of which are given], the varieties Rochester, Golden Jubilee, Vedette, Valiant, Veteran, and J. H. Hale, stored immediately after picking at 32° F., remained free from internal breakdown [*R.A.M.*, xx, p. 539; xxi, p. 85] for two to three weeks in 1940, while Elberta developed symptoms after one week; in 1941, both Elberta and J. H. Hale, held good for only one week, while Vedette and Rochester stored satisfactorily for three and four weeks, respectively. When storage was delayed until the fruit had softened to a pressure of about 10 lb. as measured by the $\frac{7}{16}$ in. point on the Ballauf pressure tester, the breakdown-free life in subsequent cold storage was substantially increased. A delay of one day for mature and two days for immature samples of Golden Jubilee, Rochester, Vedette, and Valiant peaches increased their storage

life by from one to two weeks, while J. H. Hale and Elberta needed a delay of from two to five days to prolong their life for a week.

Storage of Rochester and J. H. Hale peaches in atmospheres containing 7 and 9 per cent. of carbon dioxide at 32° failed to increase storage life, and in the case of Rochester resulted in skin injury.

BRIEN (R. M.) & ATKINSON (J. D.). **The occurrence of Stereum purpureum on the Raspberry in New Zealand.**—*N.Z.J. Sci. Tech.*, A, xxiii, 6, pp. 346–348, 2 figs., 1942.

In December, 1939, C. E. Woodhead and E. E. Chamberlain observed severe infection by *Stereum purpureum* on raspberry plants in the Wairarapa, Nelson, and Canterbury districts, this being apparently the first record of the pathogen on the host in question. On the following 27th June, the authors inoculated six Lloyd George rooted suckers in steam-sterilized soil with potato dextrose agar cultures of the fungus from raspberry, and six with the same organism from a Gravenstein apple, three plants being left untreated as controls. On 13th November, all the original canes inoculated with *S. purpureum* from both hosts were dead, but in three pots of the raspberry and four of the apple series, the new suckers in process of formation were affected by marginal browning of the leaves, defoliation, and in some cases death of the young growth. The surviving plants were transferred to a cool greenhouse, and by 9th January, 1941, typical fructifications of *S. purpureum* had developed at the dead cane bases, whence they gradually spread to the new suckers; at the end of March all the infected plants were dead, while the controls remained healthy.

TAM (E. K.) & CLARK (H. E.). **Effect of chloropicrin and other soil disinfectants on the nitrogen nutrition of the Pineapple plant.**—*Soil Sci.*, lvi, 4, pp. 245–261, 4 graphs, 1943.

A full account is given of studies at the Pineapple Research Institute, Hawaii, on the influence of soil disinfection with chloropicrin, steam, and formaldehyde, alone and in combination, on the nitrogen nutrition of the pineapple plant. Root pathogens were of little importance in the reddish-brown lateritic soil used for the experiments, and the results [which are discussed in detail] are interpreted on the basis of the action of the treatments on the nitrification processes and the subsequent effect on the assimilation of nitrogen by the plants.

Microbiological counts extending over a period of 31 weeks revealed a brief initial depression of the soil population in the treated areas, followed by such a rapid multiplication that in three to six weeks the maximum number of organisms present was immensely in excess of those in the control plots. The chloropicrin and formaldehyde treatments favoured the development of *Aspergillus* and *Penicillium* spp., while steam, alone and combined with chloropicrin or formaldehyde, and formaldehyde and chloropicrin together, eliminated nearly all the fungi except *Trichoderma*. The areas fumigated with a combination of steam and chloropicrin yielded exceptionally large numbers of bacteria and Actinomycetes six weeks after treatment, the latter possibly representing a single species with fragile, white, septate mycelia. The plants in these plots were less well-developed, both as regards their root and aerial symptoms, than those given the other treatments.

DIMOND (A. E.), HEUBERGER (J. W.), & HORSFALL (J. G.). **A water soluble protectant fungicide with tenacity.**—*Phytopathology*, xxxiii, 11, pp. 1095–1097, 1943.

Promising results in the control of *Diplocarpon rosae* and *Sphaerotheca pannosa* on roses, *Venturia inaequalis* on apple, *Cercospora apii* on celery, and *Pythium ultimum* on pea seeds were given at the Connecticut Agricultural Experiment

Station by a new water-soluble, protective fungicide, disodium ethylene bis-dithiocarbamate, which forms an invisible film on the sprayed surface and is reasonably resistant to weathering, though its tenacity cannot be assessed by the most up-to-date laboratory procedure on account of its anomalous position in respect of LD 50 values [*R.A.M.*, xxii, p. 489].

Kořínek (J.). **Der Einfluss einiger im Pflanzenschutz benützter Spritzstoffe auf die Bodenmikroflora.** [The influence of some spraying materials used in plant protection on the soil microflora.]—*Ann. Acad. tchécosl. Agric.*, xvi, 4, pp. 424–429, 1941. [Czech. Abs. in *Z. PflKrankh.*, liii, 4–7, p. 267, 1943.]

Bordeaux mixture, cuprenox (copper-lime), and a mixture of lead arsenate (arsulmag) and lime-sulphur (vegetan) were applied to the soil of a 20-year-old vineyard in Czechoslovakia with a low bacterial population. Even at a dosage 20 times exceeding those applied in the ordinary course of spraying [primarily against *Plasmopara viticola*: cf. *R.A.M.*, xviii, p. 232], the experimental compounds exerted no detrimental effect on the oligonitrophile and other soil bacteria, nor did they raise the copper content of the soil by more than 0·05 per cent. at the most. In distilled water this concentration of copper may be bactericidal, but not in the soil, at any rate in the presence of detoxicating colloids and organic substances.

Baten (W. D.). & Muncie (J. H.). **A new method for computing Sugar Beet leaf area.**—*Phytopathology*, xxxiii, 11, pp. 1071–1075, 1 graph, 1943.

Recent greenhouse experiments at Michigan State College to determine the effects of copper sprays and dusts on the transpiration rate of sugar beet leaves necessitated the use of a more convenient and expeditious method of computing their area than that afforded by planimeter readings.

Areas of 200 leaves, obtained by the planimeter, were plotted against the widths, the lengths, widths and lengths, and the products of both dimensions. Straight lines were found by the method of least squares for predicting leaf areas from these measurements, and standard errors of estimate and correlation coefficients were calculated in each case. The smallest standard error of estimate was found where the prediction of leaf area was based on the product of width and length. Since the equation for the prediction of leaf areas differs very little for large and small leaves, all the data for both size groups were combined to give one predicting equation, $A = 0{\cdot}7027P$, where A represents foliar area and P the product of width and length: this was used in the construction of a nomogram, which further involved reference to the linear relation between the logarithms of the area, $0{\cdot}7027L$ and W as $\log A = \log 0{\cdot}7027L + \log W$.

The area of a sugar beet leaf with width and length equal to 3·4 and 4·5 in., respectively, is computed from the nomogram by laying a straight edge on the scale of the width axis on 3·4 and on that of the length axis on 4·5 and then reading the area of the leaf, 10·8 sq. in., on the area axis scale. The use of the nomogram permits the simple and rapid estimation of leaf areas in the field or greenhouse without detaching the leaves from the plants.

Guittonneau (G.) & Chevalier (R.). **Sur une nouvelle méthode d'analyse microbiologique des Beurres et sur l'intérêt qu'elle présente au point de vue industriel.** [On a new method of microbiological analysis of Butters and on the interest that it presents from the industrial point of view.]—*C.R. Acad. Sci., Paris*, ccxiv, 11, pp. 581–583, 1942.

An excellent selective medium for the segregation of the various groups of butter

contaminants consists of dilute skim milk-agar, digested by papain and adjusted to a hydrogen-ion concentration of P_H 3·5, at which bacterial development is inhibited in favour of a luxuriant growth of the characteristic mould flora, including *Oidium* [*Oospora*] *lactis*, *Torula*, and *Monilia* spp.

BORLAUG (N. E.). **Resistance of various textile fibres to mildew.**—*Rayon Text. Mon.*, xxiv, 8, pp. 416–418; 9, pp. 475–476, 2 figs., 1943.

The writer's studies on the resistance to mildew of various textile fibres in common use for military purposes [*R.A.M.*, xxiii, p. 71] were conducted at the Du Pont Pest Control Laboratory, Wilmington, Delaware, under the direction of Dr. W. H. Tisdale. The materials included cellulose acetate rayon, viscose process rayon, cotton, nylon, completely saponified (or deacetylated) acetate rayon, nylon transparent film, and Du Pont cellophane. Two methods of evaluation were used, viz., (1) soil burial, in which the test specimens were buried for 21 days in beds containing an active microflora; and (2) laboratory culture tests, involving the storage of the specimens for 14 days at 80° F. and 80 per cent. relative humidity in jars containing a liquid nutrient inoculated with spore suspensions of the experimental fungi, which fell into two groups, (1) active cellulose-destroyers, comprising *Chaetomium globosum*, *Metarrhizium* [? *anisopliae*], and *Stachybotrys papyrogena*, and (2) the superficial moulds *Aspergillus niger* and *Penicillium* sp.

The cellulose acetate and nylon fabrics were found to be highly resistant to fungal deterioration as measured by the soil burial tests, the former retaining 81·2 to 94·7 per cent. of its original strength according to different methods of finishing, etc., and the latter 95 to 96 per cent. In the culture tests, both materials were resistant to the cellulose-destroying fungi, but sustained extensive discoloration by *S. papyrogena*. Skeins of cellulose acetate were stored for seven weeks in the culture room without developing any trace of fungal contamination.

The remaining fabrics listed above were entirely destroyed in the soil burial tests.

HERTZ (M. R.) & LEVINE (M.). **A fungistatic medium for enumeration of yeasts.**—*Food Res.*, vii, 6, pp. 430–441, 5 figs., 1942.

Diphenyl, incorporated into a malt extract agar medium at 100 p.p.m., was found to exert a marked fungistatic action on a number of moulds [cf. *R.A.M.*, xxi, p. 13] for a period of 72 to 96 hours, while permitting the growth of most of the yeasts included in the tests. *Rhizopus nodosus* and *R. nigrificans* [? *nigricans* = *R. stolonifer*] were exceptionally resistant to the chemical, growing vigorously in the presence of 100 p.p.m. and being only slightly inhibited at 500. It has further been successfully used for the reconstitution of bacterial and yeast cultures contaminated by moulds.

JENSEN (H. L.). **Bacteriological use of agar made from Australian seaweed.**—*Aust. J. Sci.*, v, 5, p. 161, 1943.

The spread of the war to the Pacific zone necessitates recourse to home-grown supplies of agar, hitherto produced almost exclusively in Japan, for industrial and scientific purposes [*R.A.M.*, xxii, pp. 445, 491]. Two samples locally prepared from *Gracilaria confervoides* have been used for the culture of pathogenic and saprophytic bacteria, yeasts, and fungi at the Linnean Society of New South Wales, University of Sydney, with highly satisfactory results. A 2 per cent. solution of the agar solidified at a higher temperature (47° to 48° C.) than imported (37° to 38°), and the gel thus obtained was of a particularly elastic structure and therefore very suitable for streaked plates.

ANSLOW (W. K.), RAISTRICK (H.), & SMITH (G.). **Anti-fungal substances from moulds. Part I. Patulin (anhydro-3-hydroxymethylene tetrahydro-1 : 4-pyrone-2-carboxylic acid), a metabolic product of Penicillium patulum Bainiér and Penicillium expansum (Link) Thom.**—*J. Soc. chem. Ind., Lond.*, lxii, 12, pp. 236–238, 2 figs., 1943.

Patulin, anhydro-3-hydroxymethylene-tetrahydro-1:4-pyrone-2-carboxylic acid, previously derived from *Penicillium patulum*, has lately been shown to be obtainable also from various strains of *P. expansum*, isolated from mouldy apples, pears, and grapes. The metabolic product in question completely inhibits the growth of *Pythium de Baryanum*, *P. aphanidermatum*, *P. mamillatum*, and an unidentified *P.* sp. at concentrations of 1 in 400,000 to 1 in 500,000, and partially suppresses the development of these damping-off pathogens at 1 in 1,000,000.

BOTJES (J. G. O.). **De invloed van bladrolziekte op de opbrengst van verschillende Aardappelrassen.** [The influence of leaf roll disease on the yield of different Potato varieties.]—*Tijdschr. PlZiekt.*, xlvii, 1, pp. 25–31, 1941. [Abs. in *Z. PflKrankh.*, liii, 4–7, p. 218, 1943.]

In tests on the varietal reaction of potatoes to leaf roll in Holland, Up-to-Date, Wilpo, Eigenheimer, Noordeling, Bintje, and Duivelander were the most resistant to the disease, and Voran, Ultenius, Roode Star, Gloria, Iduna, Bevelander, Magneto, Industrie, Matador, Erstling [Duke of York], Thorbecke, and Paul Krüger [President] the least so. Yield reduction was smallest (0 to 5·3 per cent.) in Up-to-Date and heaviest (84·6) in President. Particular interest attaches to these observations, since the supply of certified seed available for the time being barely suffices to meet the country's demands, but growers can insure against substantial losses by the purchase of commercial stocks of the less susceptible varieties.

LIMASSET (P.) & GODARD (M.). **Nouvelles recherches sur le Phytophthora infestans (Mont.) de Bary.** [New researches on *Phytophthora infestans* (Mont.) de Bary.] —*Ann. Épiphyt.*, N.S., [vii], pp. 145–156, 1941. [Abs. in *Z. PflKrankh.*, liii, 4–7, p. 235, 1943.]

The problem of the influence of age and plant-spacing on the infection of three potato varieties by *Phytophthora infestans* was investigated under strictly controlled conditions at Versailles, Paris, in 1938 and 1939. Young plants were less severely attacked than older ones at and after the flowering stage, but this difference is attributed less to any physiological changes in the host than to the abundance of humidity provided by the dense, serried growth of the older stands, which favours the liberation of conidia and zoospores. The presence of foci of primary infection was shown to be of the first importance in relation to outbreaks of the disease, which was effectively combated by timely applications of Bordeaux mixture.

RIEMAN (G. H.) & MCFARLANE (J. S.). **Severe Potato late-blight infection in Sebago tubers.**—*Phytopathology*, xxxiii, 11, pp. 1104–1106, 1 fig., 1943.

In a series of field trials in central Wisconsin in 1941, Sebago potato tubers, normally resistant to late blight (*Phytophthora infestans*) [*R.A.M.*, xx, p. 31] contracted the disease in a severe form, one of the 19 lots examined showing 90 per cent. infection, while among the remainder the incidence ranged from 0 (in one sample only) to 86 per cent. with an average for all lots of 38 per cent. The maximum percentage of rot in a comparable series of Russet Rural samples was 83—quite a normal figure for this variety—and the average 29. Possible reasons for the unusual susceptibility of Sebago may have been the entry of the

pathogen through bruises inflicted at harvesting on the incompletely mature tubers or the development, under the exceptionally favourable conditions for *P. infestans* prevailing over a large part of the growing season, of virulent strains of the fungus capable of attacking a semi-resistant variety [ibid., xvii, p. 482].

BARRUS (M. F.) & MÜLLER (A. S.). **An Andean disease of Potato tubers.**—*Phytopathology*, xxxiii, 11, pp. 1086–1089, 1 fig., 1943.

Growing and stored potatoes of the native varieties, Morada and Rosada, in the State of Mérida, Venezuela, were found in 1939 to be affected by a disease known locally as 'buba' (small pustule or small tumour). The affected tubers bore superficial warty excrescences and were misshapen and sometimes cracked. Sections through the cortex revealed the presence to a depth exceeding 1 cm. of subglobose, oval, or irregular rusty-brown or brownish-black cavities, 500 to 1,100 by 300 to 750 (average 764 by 522) μ, the paler and smaller lesions evidently representing an earlier phase of infection than the darker ones. At least 10 per cent. of the tubers in the field under observation, situated about 10,000 ft. above sea-level, were infected by the disease, which was referred by E. V. Abbott in Peru to *Spongospora subterranea* [*R.A.M.*, vii, p. 803]. C. E. Chardon and R. A. Toro [ibid., xiv, p. 397] describe a disease of 'papa criolla' (*Solanum* sp.) tubers, also from Mérida, characterized by wart-like protuberances, which they attribute to *Polysaccopsis hieronymi*. Though agreeing as to symptoms and place of origin, the spore balls of the writers' specimens are not those of a *Polysaccopsis*; they are yellowish-brown, mostly subglobose to ovoid, 16 to 48 by 12 to 28 (28·9 by 22·7) μ, and consist of 2 to 8 united cells, each subglobose to oval but variable and somewhat flattened next to contiguous cells 10 to 16 by 7 to 12 (12·5 by 9·1) μ, enclosed by a brown, verrucose wall, 2 to 4 μ in thickness, each cell also being provided with its own wall, 1 μ thick, and a well-marked nucleus.

A few of the healthy, whole and cut Bliss Triumph tubers grown in pots of artificially infested soil developed typical 'buba' symptoms, whereas the controls remained healthy. The application to Irish Cobbler tubers of fragments of the mycelium arising from spore ball cultures merely resulted in a non-characteristic decay.

The taxonomic position of the pathogen cannot be determined until spore germination is seen.

SNIESZKO (S. F.) & BONDE (R.). **Studies on the morphology, physiology, serology, longevity, and pathogenicity of Corynebacterium sepedonicum.**—*Phytopathology*, xxxiii, 11, pp. 1032–1044, 9 figs., 1943.

At the Maine Agricultural Experiment Station, a medium ('4-d') consisting of 3 gm. each of bacto peptone, tryptose, yeast extract, and dextrose, and 1 l. water, adjusted to P_H 7, has proved highly satisfactory for the culture of *Corynebacterium sepedonicum*, the agent of potato ring rot. Dextrose may be replaced by maltose ('4-m'), of which the comparatively inexpensive bacto technical brand is quite suitable for routine work, while for stock cultures lactose ('4-m-l') may be substituted for the maltose to the extent of one-third. On the last-named medium the organism continues to make luxuriant growth after six months, whereas only a few viable cells remained in agar slant cultures after six weeks. Other appropriate substrata for stock cultures are milk and litmus milk. Potato and carrot extracts have also given good results in the writers' cultural experiments with *C. sepedonicum*, but care must be taken to maintain the medium at P_H 7 to obviate undue acidity. The new medium (4-m-l plus agar), with the addition of sodium dichromate (1 in 12,000), can be used for the isolation of *C. sepedonicum* from potato tubers with symptoms of soft rot due to secondary infection with *Erwinia carotovora*.

The best sources of carbon for the ring-rot pathogen are the monosaccharides

arabinose, xylose, dextrose, galactose, and levulose, followed by mannitol, their decomposition being accompanied by a slow, and sometimes only temporary, increase in the acidity of the substratum.

Pure cultures of the ring-rot organism, added to sterile loam soil and left buried in the ground, survived from October, 1941, to May, 1942, and retained their virulence [*R.A.M.*, x, p. 52]. On laboratory media, however, *C. sepedonicum* loses its pathogenicity within six months. Infection experiments in which the inoculum consisted of (*a*) macerated ring-rot tubers stored for 13 days before use, and (*b*) tubers badly decayed by *C. sepedonicum* gave negative results.

The ring-rot organism is weakly antigenic for rabbits, producing agglutinating sera with low titre. All strains tested were cross-agglutinated approximately up to the titre of all sera.

Biennial Report of the Rice Experiment Station, Crowley, Louisiana, 1939–1940, 42 pp., [? 1941.]

The following phytopathological problems were studied during the period under review: 'pecky' rice by W. A. DOUGLAS and T. C. RYKER; root rot by T. C. RYKER and W. A. DOUGLAS; and rice diseases in Louisiana in 1939 and 1940 by T. C. RYKER. Of the various fungi tested in greenhouse experiments for their capacity to induce 'peckiness' (hull-spotting and kernel discoloration) in the Early Prolific variety, *Helminthosporium oryzae* [*Ophiobolus miyabeanus*], *Curvularia* spp., *Helicoceras* sp., and *Fusarium moniliforme* [*Gibberella fujikuroi*] were the most active. Extensive discoloration, accompanied by sterility, was also caused by infestation with stinkbugs (*Solubea pugnax*). In 12 fields of Blue Rose, *O. miyabeanus* was responsible for the maximum incidence of 'peckiness', followed by *Trichoconas* sp. and *C.* spp.

Both root maggots (*Lissorhoptrus simplex*) and *Pythium* spp. were found to be associated with root rot, the fungi, however, being also present on apparently healthy plants and presumably assuming a parasitic character only under favourable conditions, notably high soil temperatures, low fertility, and comparatively high alkalinity. The application of a 10–10–0 fertilizer at the rate of 400 lb. per acre to diseased areas in drained fields was uniformly beneficial in 1940, resulting in yield increases of 5·5 to 25·4 bush. per acre (average 12·6).

Head smut (*Tilletia horrida*) is of very sporadic occurrence, mainly affecting the Rexoro variety on new or fertile soil. Its importance lies in the production of an 'off' colour in the milled product by a relatively low percentage of diseased heads.

Besides causing kernel 'peckiness', *O. miyabeanus* attacks the glumes, which constitute a potential source of inoculum in plants used for seed. In experiments in 1938 and 1939 in which lots of cleaned and uncleaned, heavily infected seed were grown in adjacent blocks, in a badly diseased field severe leaf spot developed in both series, but there was practically no seedling blight in either.

The information on *Cercospora oryzae* has been noticed from other sources [*R.A.M.*, xxii, p. 224].

JENSEN (H. L.). **Observations on the vegetative growth of Actinomycetes in the soil.**—*Proc. Linn. Soc. N.S.W.*, lxviii, 3–4, pp. 67–71, 2 graphs, 1943.

The microscopic examination, by means of the contact-slide method, of four soil samples, viz., (1) sand-mixed grey loam, P_H 7·7, plus 1 per cent. dry mycelium of *Penicillium*, (2) 'synthetic' soil (sand-kaolin mixture) plus *P.* mycelium, (3) same as (1) plus 1 per cent. hay meal, and (4) red loam, P_H 4, plus hay meal, showed the vegetative development of Actinomycetes to be favoured by a relatively low moisture content and an increase in temperature between 5° and 28° C. No further stimulation of growth occurred at 37°, while at 5° the development of the

organism was negligible. Broadly speaking, therefore, the Actinomycetes, as a group of the soil population, seem to be adapted to a somewhat higher temperature range than the fungi and bacteria, which reach their maxima at 5° to 15°.

REINMUTH (E.). **Weitere Beobachtungen über die parasitäre Blattdürre des Ölmohns.** [Further observations on the parasitic leaf desiccation of the Opium Poppy.]—*Angew. Bot.*, xxv, 3–4, pp. 300–302, 1943.

The work of Ekstrand and other Swedish plant pathologists on the opium poppy [*Papaver somniferum*] disease caused by *Pleospora calvescens*, which had hitherto escaped the writer's notice, is summarized [*R.A.M.*, xxii, p. 39]. Both in Sweden and the Rostock district of Germany, the crop sustained much less damage in the relatively cool season of 1942 than in the exceptionally warm one of 1941. At Rostock the mean temperatures during the critical months of June and July, 1941, exceeded those of the 50-year local mean, whereas in the same period of 1942 they fell below it. A warm spell in August of the latter year was accompanied by a brief renewal of the epidemic, which did not persist, however, when cooler and moister conditions developed, the place of *P. calvescens* being largely taken by various combined infections, including *Fusarium* spp., *Sclerotinia sclerotiorum*, and *Botrytis*.

CROSS (W. E.). **Como obtener maximos rendimientos con las Cañas atacadas por el 'carbon'.** [How to obtain the maximum yields from Canes attacked by 'smut'.]—*Bol. Estac. exp. agríc. Tucumán* 42, 8 pp., 1943.

This is an explanatory discussion of the three chief cultural factors concerned in the procurement of maximum yields from sugar-cane varieties susceptible to smut [*Ustilago scitaminea*] in Argentina [*R.A.M.*, xxii, p. 326], namely, appropriate methods of cultivation, including the precautionary measure of burning the stubble after harvest; provision of adequate humidity, the first irrigation to precede the preparation of the field and later ones to be applied at discretion (e.g., more frequently in sandy than in clay soils); and the use of nitrogenous fertilizers of agricultural origin, e.g., well-aerated farmyard manure, air-dried scum of boiled cane juice, Chile saltpetre, dried blood, meat flour ('tankage'), and cotton, sunflower, groundnut, or castor cakes.

SĂVULESCU (T.). **Die auf Compositen parasitierenden Plasmopara-Arten.** [The *Plasmopara* species parasitizing Compositae.]—*Bull. Acad. roum.*, Sect. sci., xxiv, 1, 23 pp., 1941. [Abs. in *Z. PflKrankh.*, liii, 4–7, p. 238, 1943.]

Besides *Plasmopara halstedii*, hitherto the sole representative of the genus known to attack a number of Compositae, the author found two new species, *P. megasperma* Săvul. on *Scorzonera humilis* (in Rumania only) and *P. sphaerosperma* Săvul. on various subspecies of *Tragopogon dubius* in Rumania, Italy, Czechoslovakia, and Switzerland. The differentiation of the new species is effected on the basis of the shape and size of the conidia and conidiophores. *Bremia lactucae* on *T.* spp., as represented in various herbaria, was found to be identical with *P. sphaerosperma*.

SELMAN (I. W.). **The appearance and spread of mosaic infection in the Tomato crop and the relation to seed transmission of the virus.**—*Ann. appl. Biol.*, xxx, 4, pp. 331–338, 5 figs., 1943.

The results of three experiments, carried out at the Cheshunt Research Station from 1940 to 1942, comparing the reactions of tomato plants raised from virus-free and [tobacco mosaic] virus-infected seed are tabulated and discussed. The experimental plots were distributed at random in a house in which no precautions against entry or spread of virus were taken. In the first two experiments freedom

from mosaic infection was maintained longest in plants raised from virus-free seed, but in the third, carried out in 1942 after steam sterilization of the soil, mosaic infection occurred later in the life of the plants and there were no differences between the two series. The author concludes that there is 'delayed' seed transmission of mosaic-inducing viruses in the tomato crop and that this condition can, as yet, only be interpreted in terms of differences in the resistance of plants raised from seed of different origin to the multiplication and spread of the viruses. Tests made of the virus content of infected tomato seed during germination showed differences in the persistence of virus during germination in seeds of differing origin.

Evidence is also presented to show that, in the second experiment, mosaic symptoms tended to appear first on plants where the depth of top soil was greatest.

WELLMAN (F. L.). **Comparative toxic effects of extracts from mild and virulent isolates of Tomato-wilt Fusarium.**—*Phytopathology*, xxxiii, 11, pp. 1004–1017, 4 figs., 1 graph, 1943.

Observations were made on the comparative toxicity to excised Bonny Best and Marglobe tomato tops of filtrates from cultures of various ages of mild and virulent strains of the wilt fungus (*Fusarium bulbigenum* var. *lycopersici*) in which the cut ends were immersed. Liquid filtrates from vigorously growing cultures were severely toxic to the leaf blades, petioles, and apical buds, while those from cultures in the incipient stage of 'staling' caused intensive injury of the plant tops, involving stem collapse [*R.A.M.*, xxii, p. 331]. The virulent strain of the fungus produced a considerably larger quantity of toxic material in liquids than the mild one, while the filtrates of the former became highly toxic after a much shorter incubation period than those of the latter, the increase in toxic effect taking place from the 6th to the 12th and from the 11th to past the 30th days of culture, respectively. The toxic effects of 'staled' cultures of either isolate were of approximately equal severity, while protracted ageing (up to a year or longer) in flasks reduced the pathogenicity of both to a comparably low level.

MADHOK (M. R.) & UD-DIN (F.). **Bacterial soft rot of Tomatoes caused by a spore forming organism.**—*Indian J. agric. Sci.*, xiii, 2, pp. 129–133, 2 pl., 1943.

In the autumn of 1938, tomato fruits of the large red variety, Pocha and Sons, at the Punjab Agricultural College, Lyallpur, developed a subepidermal soft rot, which spread rapidly, reducing the tissue to a pulp in four to six days. Isolations on beef extract-agar gave rise to a strictly aerobic, Gram-positive bacterium occurring singly in the form of a rod with rounded ends, 1·25 to 2·5 by 0·75 to 1 μ, motile with peritrichic flagella; producing central, ovoid spores, 1·2 by 0·75 μ; liquefying gelatine but not forming indol, reducing nitrate, or hydrolysing starch; evolving acid from sucrose, dextrose, mannite, arabinose, and glycerol, and ammonia from peptone; growth range 10° to 55° C., with an optimum at 40°; the vegetative cells surviving ten minutes at 70° and the spores half-an-hour at boiling point. The organism, which is named *Bacillus frutodestruens* n.sp., produced two types of colony, one dull white and spreading, with an irregular margin, and the other circular, smooth, creamy-white, with an even margin. The results of inoculation experiments showed the bacterium to be a virulent pathogen, the lesions, brownish at first, turning darker and wrinkling and finally disorganizing the whole fruit with the exudation of a malodorous liquid.

SMITH (T. E.). **Distribution of bacterial wilt (Bacterium solanacearum) in successive crops of Tobacco grown on the same fields.**—*Phytopathology*, xxxiii, 11, pp. 1076–1080, 1 diag., 1943.

Data from 141 tobacco plots at Oxford, North Carolina, revealed a strong

positive correlation between the incidence of wilt (*Bacterium* [*Xanthomonas*] *solanacearum*) in 1938 or 1940 and that of the disease on the same plots planted to tobacco in 1940 or 1942, infection being usually, but not invariably, more severe on the low-lying areas. The similarity of the pattern of occurrence from year to year suggests that the observed uneven distribution of the disease is correlated with permanent soil conditions rather than with the spread of inoculum by cultural operations or surface water.

MIELKE (J. L.). **White Pine blister rust in western North America.**—*Bull. Sch. For. Yale* 52, 155 pp., 1 fig., 13 maps, 1943. $1.

In his introductory note to this valuable monograph, the author emphasizes the need for further research on some of the unsolved problems relating to the epiphytology of white pine blister rust (*Cronartium ribicola*) [*R.A.M.*, xxii, p. 378], and describes the present contribution as 'a summary of evidence so far obtained on the subject rather than a completed record'.

The pathogen was first observed in western North America at Vancouver, British Columbia, in the autumn of 1921, having been introduced into the locality direct from France in 1910 in a single nursery shipment of eastern white pines (*Pinus strobus*). All the seven species of white pine in the west, viz., *P. monticola*, *P. lambertiana*, *P. albicaulis*, *P. flexilis*, *P. balfouriana*, *P. aristata*, and *P. ayacahuite*, are known to be susceptible to *C. ribicola*, but so far only the first three have contracted natural infection, *P. monticola* being the preferred host of the rust.

About three-quarters of the 60 native species of wild *Ribes* in the western United States and western Canada have been found susceptible to blister rust [ibid., xxii, p. 392], including *R. bracteosum*, *R. divaricatum*, and *R. sanguineum*, prevalent in the white pine section of the coastal belt of British Columbia [ibid., xvii, p. 639], and *R. nevadense* and *R. roezlii* in the Sierra Nevada of California, besides the European black currant (*R. nigrum*), which may still be grown unrestrictedly in British Columbia, though between 1922 and 1927 it had been eradicated from Montana, Idaho, Washington, Oregon, and about two-thirds of California, according to S. N. Wyckoff in his report of the work of the Western White Pine Blister Rust Conference (1927).

In the course of field investigations in 1922–3, circumstantial evidence was obtained of the capacity of the rust to spread from pine to *Ribes* for distances upwards of 100 miles by means of wind-borne aecidiospores, whilst data accumulated during the last 20 years indicated that, under favourable conditions, spread may occur over distances of 300 to 400 miles and possibly further. In this connexion, records of upper-air winds have proved much more valuable than those dealing with surface movements, the direction of which is largely dependent on local topography. With the aid of charts of the upper-air winds it has been possible to forecast with a high degree of accuracy the southward spread of infection to *Ribes* in California. Moisture is a very important contributory factor in the dissemination and intensification of *C. ribicola*, a wide extension of which may be anticipated in any season when wind and humidity combine to favour its development. The spread of rust has been wave-like in character, the waves being irregularly timed owing to the weather and other conditions not being favourable for heavy pine infection locally, with long-distance spread to *Ribes* and the subsequent establishment of the fungus in fresh localities. The years 1917, 1921, 1923, 1927, and 1937 were outstanding in this regard. While the rust has extended more to the south than to the east, the intensity of spread has been heaviest eastward. Black currants are stated to have played only a very minor part in the spread of the rust on pines except in the interior of British Columbia. Spread from pines to *R. nigrum* has not been any further than to susceptible wild species.

Blister rust (*C. occidentale*) of piñon pines (*P. edulis* and *P. monophylla*), the alternate hosts of which are also *R.* spp., notably *R. roezlii* in northern California, is indistinguishable in its uredo and teleuto stages from *C. ribicola* by ordinary methods, but may be readily differentiated in the latter phase by a microchemical colorimetric procedure [ibid., xvii, p. 150].

There is at present no reason to believe in the existence of more than one physiologic race of *C. ribicola.*

WATERMAN (ALMA M.). **Diplodia pinea, the cause of a disease of hard Pines.**—*Phytopathology*, xxxiii, 11, pp. 1018–1031, 1 fig., 1943.

Discussing the taxonomy of *Diplodia pinea*, the agent of a widely distributed disease of hard pines, notably *Pinus nigra, P. sylvestris,* and *P. mugo* var. *mughus,* in the United States [*R.A.M.*, xxiii, p. 83], the writer cites a number of illustrations of the existing confusion in the systematic position of the fungus as interpreted by Birch [ibid., xvi, p. 148], Haddow and Newman [ibid., xxi, p. 398], and others. However, since Desmazières's name *Sphaeria pinea,* changed by Kickx to *D. pinea,* antedates the other species mentioned, including *D. megalospora* Berk. & Curt., *Sphaeropsis pinastri* Cke & Ell., *S. ellisii* Sacc., *S. pinicola* Speg., and *D. conigena* Desm., *D. pityophila,* and *D. sapinea,* found by Stevens to have similar spore measurements, it is the preferred designation for the pathogen.

Although *D. pinea* has not yet been observed to cause serious damage in forest plantations, it often assumes a severe form on ornamentals, the killing-back of the current season's growth for several consecutive years resulting in the enfeeblement and sometimes death of the affected trees. The new growth may be attacked in various ways, i.e., by direct infection of the young needles, the elongating shoot, or one bud of a terminal cluster, whence the mycelium migrates into adjacent buds or into the twig, and by the spread of the mycelium from a twig invaded the previous year.

Young (5- to 10-year-old) *P. nigra, P. sylvestris, P. resinosa, P. ponderosa,* and *P. strobus* trees in an experimental plot at Yale University, New Haven, Connecticut, were inoculated with the mycelium or immature fruiting bodies from monospore cultures of *D. pinea* from *P. nigra* and *P. resinosa* on Leonian's synthetic medium [ibid., iii, p. 544]. Positive results were secured on unwounded buds of *P. sylvestris, P. resinosa,* and *P. ponderosa,* injured buds of *P. nigra, P. sylvestris,* and *P. ponderosa,* undamaged leaves of *P. nigra, P. sylvestris, P. resinosa,* and *P. ponderosa,* leaf scars of *P. nigra, P. sylvestris,* and *P. resinosa,* and twig wounds of *P. nigra, P. sylvestris,* and *P. resinosa. P. strobus* remained free from attack. These results confirm previous observations as to the capacity of *D. pinea* for the infection of healthy, actively growing bud and foliar tissue, though wounds promote its readier access to the trees.

DAVIDSON (R. W.) & CAMPBELL (W. A.). **Decay in merchantable Black Cherry in the Allegheny National Forest.**—*Phytopathology*, xxxiii, 11, pp. 965–985, 7 figs., 1943.

A tabulated survey is given of investigations to determine the extent of cull caused by wood-rotting fungi in three merchantable black cherry (*Prunus serotina*) stands, of 52, 116, and 120 years old, in the Allegheny National Forest, Pennsylvania [cf. *R.A.M.*, xx, p. 184], of which the first and third were open-grown and the second virtually pure. The incidence of decay in the 52-, 116-, and 120-year-old stands, based on board-foot volume, amounted to 2·3, 11·3, and 6·1 per cent., respectively, the most important butt rots being due to *Polyporus spraguei* (14 isolations from 212 infections), *P. berkeleyi* (9), and *Coniophora cerebella* [*C. puteana*] (8), while the principal agents of trunk infection were *Poria prunicola* (62), *P. mutans* (18), *Fomes pinicola* (32), and *Polyporus sulphureus* (28). Large

branch stubs provided the main source of ingress for the pathogens, except *Poria mutans*, which usually entered the tree through large wounds. *F. pinicola* produced fruit bodies on about half the trees it attacked, but otherwise there was little or no evidence of the wood rots. Besides the organisms already mentioned, the diseased material yielded 10 isolates of *P. sericeo-mollis*, 9 of *Polyporus fibrillosus*, 5 each of *Poria inflata* and *Trametes serialis*, 3 each of *P. cocos* and *Polyporus subcartilagineus*, 2 each of *P. balsameus*, *P. frondosus*, *P. schweinitzii*, *Hydnum* sp., and *Omphalia campanella*, and one each of *Corticium lividum*, *P. fibrillosus*, *P.* [*Polystictus*] *versicolor*, *Poria xantha*, and *Stereum rameale*.

It is concluded that superior-grade black cherry can be grown to large saw-log size without excessive loss from decay by means of judicious silvicultural practices, including the removal of forked trees and the elimination of multiple sprout clumps or their reduction to single stems at an early age.

Grondal (B. L.) & Mottet (A. L.). **Characteristics and significance of white floccose aggregates in the wood of Western Hemlock.**—*For. Cl. Quart.*, xvi, 1, pp. 12–18, 4 figs., 1942–1943.

The presence in the heartwood of water-soaked western hemlock (*Tsuga heterophylla*) logs of small, white, floccose flecks and streaks, known as 'floccosoids', is stated to be responsible for the rejection of substantial quantities of timber of this species as unfit for aircraft construction, since inspectors confuse the defect with the incipient stages of decay by *Trametes* [*Fomes*] *pini* [*R.A.M.*, xxii, p. 187].

Microscopic studies at the College of Forestry, University of Washington, showed the 'floccosoids' to consist of white, pseudo-amorphous or granular deposits in the cell lumina of the tracheids, especially of the spring wood, though the summer wood may also be invaded in the case of larger aggregates. When the wood becomes dry, the 'floccosoids' assume a crystalline aspect, but so far the authors have been unable to reach a conclusion as to their chemical identity.

Negative results were given by tests to determine the possibility of a connexion between infection by *Ganoderma oregonense* [ibid., xix, p. 445] and the occurrence of 'floccosoids', which are believed to exert no adverse effect whatever on the strength of the wood. The following tests are suggested for the differentiation of 'floccosoids' from the white spots due to decay. (1) If the area including the white spot is as firm as the spring wood at either end of the deposit, the latter is a floccosoid: if, on the other hand, the white spot is softer than the spring wood and contains small cavities, it is caused by a wood-destroying fungus. (2) If a very thin sliver of wood from the suspected area is immersed for a few minutes in a 4 per cent. solution of sodium hydroxide, the 'floccosoids' will disappear, whereas white spots due to fungal infection will persist, or the wood in the affected zone will become more transparent than that of the surrounding portion.

Plakidas (A. G.). **Diseases of some vegetable and fruit crops and their control.**—*Bull. La agric. Exp. Sta.* 357, 92 pp., 32 figs., 1943.

This useful handbook comprises much valuable information, accumulated at the Louisiana Agricultural Experiment Station over a period of several years, on the most important parasitic (including virus) and physiological diseases of some vegetable and fruit crops grown in the State, and on their control by cultural measures and spraying or dusting and seed treatments. The bulletin is intended to assist farmers in the fulfilment of the requirements of the food production programme.

Babb (M. F.) & Bohn (G. W.). **Control of soil-borne organisms that cause rots of garden Peas.**—*Phytopathology*, xxxiii, 11, pp. 1098–1100, 1943.

In experiments during the winter of 1941–2 at the Cheyenne (Wyoming)

Horticultural Field Station, good control of the soil-borne fungi (including a virulent Oomycete and a *Fusarium*) causing rots of garden peas [*R.A.M.*, xiv, p. 279] was obtained by treatment of the soil in 2-gal. jars with either 1 l. of a 1 in 50 dilution of 40 per cent. formaldehyde, live steam for six hours, or 2·2 oz. chloropicrin. Seed disinfection with new improved ceresan, semesan, spergon, or red cuprocide gave less satisfactory results. The application of spergon to the seed did not impair the efficiency of the soil treatments, but a combination of the latter with new improved ceresan was deleterious. The good stands derived from untreated seeds in steamed soil and in unsterilized soils from three areas comparatively remote from cultivated land point to the soil as the source of the pathogens rather than the seed.

PERSON (L. H.) & CHILTON (S. J. P.). **Seed and soil treatment for the control of damping-off.**—*Bull. La agric. Exp. Sta.* 349, 16 pp., 1942.

A tabulated account is given of the results of seven years' studies at the Louisiana Agricultural Experiment Station on the control of damping-off (*Rhizoctonia* and *Pythium* spp.) of vegetables and ornamentals in Sharkey (alluvial) and Olivier (upland or terrace) soils. The most effective treatment for tomatoes and bell peppers [*Capsicum annuum* var. *grossum*] was the application to the seed of red or yellow copper oxide (frequently sold under the names of cuprocide and yellow cuprocide) at the rate of 1½ level teaspoonsful per lb. of small seed or ½ teaspoonful per lb. of large, followed if necessary by the sprinkling on the soil surface at emergence of 1¼ oz. (six level teaspoonsful) of either dust per gal. water. The copper oxides are toxic to cabbage, the seed of which should be treated with vasco 4 or zinc oxide (also known as zinc white, paint white, or leafox 200) at a strength of two teaspoonsful per lb. Both substances may also be applied to the soil at emergence through holes in the bottom of a can, allowing 2 oz. per 3 sq. ft. The manufacture of vasco 4 has been temporarily discontinued owing to war priorities. Eggplants should always be given a soil treatment with one of the copper oxides, vasco 4, or zinc oxide in addition to seed disinfection with red or yellow copper oxide. Both the oxides, particularly the yellow, gave good control of damping-off of *Calendula*, *Centaurea*, *Cosmos*, pansy [*Viola tricolor*], *Salvia*, and *Zinnia*.

RAINIO (A. J.). **Untersuchungen über Cucumis virus I, Erreger der Kräuselkrankheit auf Gurkenpflanzen.** [Studies on *Cucumis* virus 1, the agent of the crinkle disease of Cucumber plants.]—*Valt. Maatalousk. Julk.* 109, 24 pp., 13 figs., 1941. [Finnish, with German translation. Abs. in *Z. PflKrankh.* liii, 4–7, pp. 218–219, 1943.]

The principal features of a disease affecting cucumbers in Finland, namely, the formation of protuberances on the aerial organs, accompanied by arching and crinkling of the leaves and, in extreme cases, by sterility, agree with those described from the United States by Doolittle in 1920 as typical of cucumber mosaic, caused by *Cucumis* virus 1 [cucumber mosaic virus]. Besides aphids, centipedes assist in the spread of infection, which is also carried by the seed and gains ingress through wounds, especially those inflicted with the pruning knife. In dry plant organs the virus retains its viability for a year, both in the greenhouse and in the field. Control measures should include extermination of the insect vectors, removal of suspected plants, disinfection of the pruning knife with 2 per cent. formalin, and the use of healthy seed.

VASUDEVA (R. S.) & LAL (T. B.). **A mosaic disease of Bottle Gourd.**—*Indian J. agric. Sci.*, xiii, 2, pp. 182–191, 2 figs., 1943.

In May and June, 1941, a widespread infection of bottle gourds (*Lagenaria*

vulgaris) by a systemic mosaic disease was observed in the vicinity of Delhi, the symptoms of which included chlorotic streaks, dark green blisters, appearing as small, convex areas on the upper leaf surface, wavy and irregular outlines, wrinkling, and in some cases regular mottling in the shape of minute, pale and dark green areas all over the leaf blade. The older leaves shrivel and drop in about seven weeks. Plants attacked early in the season remain small, flower sparsely, and set few fruits. Inoculation experiments in insect-proof houses with extracts from diseased plants gave positive results on cucumber, *Momordica charantia*, melon, watermelon, and vegetable marrow.

The bottle gourd mosaic virus, which is named *Cucumis* virus 3, is destroyed by six hours' storage at room temperature, loses its infectivity at a dilution of 1 in 500, and succumbs to ten minutes' exposure to a temperature of 60° C. It does not traverse Chamberland filters of grades L 1 to L 5, and its virulence is greatly reduced by passage through filter paper.

Kligman (A. M.) & Penny (J. S.). **Some miscellaneous diseases of Mushrooms.**—*Phytopathology*, xxxiii, 11, pp. 1090–1093, 1 fig., 1943.

The writers' experiments at the University of Pennsylvania on the inoculation of mushroom beds with *Fusarium solani* var. *martii* and *F. oxysporum*, isolated from pine seedlings, failed to induce in the mushrooms the symptoms attributed to these fungi by F. C. Wood in England [*R.A.M.*, xix, p. 5], and his conclusion that they are responsible for the disease in question is therefore held not to be substantiated.

The results of the authors' investigations on the 'mummy' disease are in essential agreement with those of Tucker and Routien from Missouri [ibid., xxiii, p. 54]. *Pseudomonas fluorescens* was consistently isolated from the greenish-grey slime commonly occupying the discoloured pits, streaks, and channels in the cap and stem tissues, and sometimes occurring in globule form between the gills. Spread of the disease down the bed may be controlled by a trench, 1 ft. wide, across the bed and about 5 ft. in advance of the disease, whilst a 2 per cent. formalin drench was effective in two instances. The same organism was associated, but evidently only in a secondary capacity, with the disease described by W. S. Beach [ibid., xvii, p. 792] as bacterial pit, the true agent of which, however, is believed to be a mite, probably a *Rhizoglyphus*.

Bacterial blotch (*P. tolaasi*) [loc. cit.] is prevalent in the caves of Butler county, Pennsylvania, but attempts to introduce it into the Kennett Square houses were only partially successful, and there is considered to be little risk of its becoming established in the latter area.

Ollram (E.). **Wirkliche und scheinbare Mängel am Rebschnittholz.** [Real and apparent defects on trimmed Vine wood.]—*Dtsch. Weinb.*, xx, pp. 234–235, 6 figs., 1941. [Abs. in *Z. PflKrankh.*, liii, 4–7, p. 266, 1943.]

'Mauke' [crown gall: *Bacterium tumefaciens*] on vines may extend as far upwards as the limits of the ripe wood [*R.A.M.*, xiv, p. 740], where its excrescences, however, are smaller than near soil-level. Although infected trimmings may produce healthy and long-lived stocks, they should preferably be excluded from propagation in order to avoid soil infestation. Situation, soil, and manuring do not in themselves influence the development of 'mauke'. A spurious form of the disease, more prevalent than the real, originates in the cracks made during operations on the foliage, which frequently develop tuberous swellings and become filled with parenchymatous cortical tissue, penetrating right down to the medullary tube. These tissues afford ingress to fungi and sometimes to *Bact. tumefaciens* and gum-secreting bacteria.

WITTE (H.). **Redogörelse för verksamheten vid Statens centrala frökontrollanstalt under tiden 1/7/1941–30/6/1942.** [Report on the work of the State Seed Testing Station for the period from 1st July, 1941, to 30th June, 1942.]—*Medd. Frökontrollanst. Stockh., 1943*, 18, pp. 3–68, 4 figs., 1943. [English summary.]

The following are among the items of phytopathological interest in this report [cf. *R.A.M.*, xix, p. 691]. Of the 22,407 samples of cereal seed-grain tested for *Fusarium* infection, 64·9 per cent. were entirely free and only 0·1 per cent. very severely attacked, the corresponding figures for the very slight, slight, fairly severe, and severe, categories being 24·7, 6·7, 3, and 0·6 per cent., respectively. It was estimated that only 7 per cent. of the total number of samples examined were in a condition to require disinfection. A survey of the period from 1934 to 1941 in respect of fusariosis reveals a marked decline in the incidence of infection from 1935 to 1937, followed by a rise in the two succeeding years and another sharp drop in 1940 and more particularly in 1941.

Wheat bunt [*Tilletia caries* and *T. foetida*] occurred in 28·4 per cent. of the 162 winter wheat samples examined, the corresponding figures for the loose smuts of wheat [*Ustilago tritici*] (winter and summer) and barley [*U. nuda*] being 14·8 per cent. out of 162, 34·1 per cent. out of 85, and 84·3 per cent. out of 121, respectively. Out of 460 oats samples inspected, 38 per cent. were free from smut [*U. avenae* and *U. kolleri*]. Stripe disease [*Helminthosporium gramineum*] was present in 67·8 per cent. of the 121 barley samples tested.

Sugar and marrowfat peas were more severely damaged by *Ascochyta pisi* than the boiling varieties, the infection percentages for the three groups being 37, 19, and 7, respectively. Beans were occasionally attacked by *Macrosporium commune* [? *Pleospora herbarum*], which is controllable, however, unlike the foregoing, by seed disinfection with mercurials.

ÅKERMAN (Å.). **Årsberättelse över Sveriges Utsädesförenings verksamhet under år 1942.** [Annual report of the work of the Swedish Seed Association for the year 1942.]—*Sverig. Utsädesfören. Tidskr.*, liii, 3, pp. 117–169, 1 graph, 1943.

The following items of phytopathological interest occur in this report. Winter wheat at Svalöf sustained exceptionally heavy damage from fusariosis [*Fusarium* spp.] and black chaff (*Bacterium translucens* var. *undulosum*) [*Xanthomonas translucens* var. *undulosa*], the latter being particularly severe on the Äring II and III varieties, plots of which showed a dark brown discoloration visible from a considerable distance. The very winter-hardy line Sv 28/1056 (originating from Halland wheat), which is being extensively used as a parent in new crosses, proved to be virtually immune from black chaff, as also are all the Svalöf-bred winter varieties now available on the market. The same disease occurred in a virulent form on summer wheat, especially on Atle, some local sorts from Halland and Dalarna, and a number of varieties comprised in a large American consignment, including Apex and Renown. Winter wheat in west Norrland and timothy [*Phleum pratense*] in north-west Ångermanland showed profuse infection by *Sclerotinia borealis* [*R.A.M.*, xxii, p. 99], which was likewise observed on winter rye in northern Norrland and Jämtland, experimental grass plots laid down in 1941 also being attacked in the former region: red fescue [*Festuca rubra*] and other species from the south of the country were almost totally destroyed. This pathogen, formerly known only as a relatively innocuous concomitant of *Fusarium nivale* [*Calonectria graminicola*] and *Typhula borealis*, has now assumed an independent and destructive habit.

Six-rowed barley at Svalöf was heavily infected at the beginning of July by *Helminthosporium teres*.

Flax at Svalöf was severely damaged by *Polyspora lini*.

Discoveries and current events. Italy. Plant pathology notes.—*Int. Bull. Pl. Prot.*, xvii, 1, pp. 1M–2M, 1943.

In lemon groves severely affected by 'mal secco' disease (*Deuterophoma tracheiphila*) [*R.A.M.*, xx, p. 398] in Sicily, the Monachello variety of lemon [ibid., xiv, p. 680] is grafted on to bitter orange [*Citrus aurantium*: ibid., xii, p. 565]. Monachello is very suitable for the coarse, shallow soil of the Province of Messina but not for the clay soil of certain other parts of the island. Its resistance to 'mal secco' is high once the plants have attained a certain development, but moderately weak during the first year after grafting. Where it is used, windbreaks should be planted, and fungicidal sprayings carried out in spring and autumn.

Peach trees in Friuli have been killed off by non-parasitic leptonecrosis [ibid., xiv, p. 454]. The conidial stage (*Gloeosporium*) of *Physalospora miyabeana* [ibid., xxi, p. 544], new to Italy, was found on *Salix babylonica* at Busalla, Genoa.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 10, pp. 511–517, 12 figs., 1943.

Target spot or early blight (*Alternaria solani*) [*R.A.M.*, xxii, p. 288] occurs almost everywhere in Victoria where tomatoes are grown. During 1943, serious infection was present in several commercial nurseries, having originated, apparently, in the seed. Starved plants are very susceptible, as may be seen in seedlings allowed to remain too long in seed-boxes or seed-beds before transplanting. Such seedlings generally outgrow infection if treated promptly with a nitrogenous fertilizer. The disease is seldom serious in the field in the chief tomato-growing areas of the State, and its presence is generally an indication of inadequate manuring. As infection develops most rapidly when atmospheric humidity is high and air temperatures are between 75° and 85° F., early and late tomatoes are most susceptible. Spores of the fungus may also gain entry to the fruit through growth cracks, stem scars, or insect punctures causing decay. Heavy losses are sometimes caused in out-of-season tomatoes imported into Victoria from South Australia and Western Australia and kept in the warm, humid, ripening rooms. Such fruit seldom shows decay on arrival.

The following recommendations are made for control. Only firm, healthy fruit should be selected for seed purposes. Old tomato soil should not be used for seed-beds, virgin soil being obtained whenever possible. Affected seedlings should be sprayed as soon as the symptoms are noticed with copper oxychloride (1 oz. to 3 gals. water) or Bordeaux mixture (3–3–40). To obviate damage from heavy droplets of Bordeaux mixture collecting on the topmost leaves, they should be dislodged by a water spray applied as a fine mist. Two or three applications of either chemical are necessary in the seed-bed, the last Bordeaux treatment being applied at least five days before removing the plants to the field. If tomatoes need to be protected in the field, they should be treated with a 7 per cent. copper dust.

Citrus black pit (*Phytomonas* [*Pseudomonas*] *syringae*) [ibid., xxii, p. 133] periodically reaches epidemic proportions in Victoria and was very common there in 1943, when hail and frost injuries were numerous. Control consists in improved orchard sanitation, the provision of windbreaks, the use of thornless varieties, and spraying in autumn and spring with Bordeaux mixture (3–3–50) plus 1 lb. lime casein spreader.

Braun (A. C.). **Studies on tumor inception in the crown-gall disease.**—*Amer. J. Bot.*, xxx, 9, pp. 674–677, 1 fig., 1943.

A study of the period of time required by *Phytomonas* [*Bacterium*] *tumefaciens* [cf. *R.A.M.*, xxiii, p. 8] to change normal host cells to neoplastic cell types showed that by subjecting the host-parasite complex to a temperature of 46° to 47° C.

it was possible to kill the bacterium at any time after it had become established in periwinkle (*Vinca rosea*) plants, though the host was not seriously affected by the treatment. The evidence demonstrated that the change from normalto tumour cells may be induced by the organism as early as 36 to 48 hours after inoculation, though the resulting galls remained very small during the three months' period of the experiment and full expression is not attained until the fourth day. A four-day incubation period resulted in the ultimate formation of tumours in every way comparable to those of the inoculated but unheated controls. The cellular alteration is evidently brought about within four days after inoculation of the host with the organism. The continued abnormal development of the neoplastic cells becomes at this early stage independent of the bacterium. The altered cells then multiply autonomously and develop into large tumorous overgrowths. These results suggest that any attempt to isolate the material that initiates tumour development may be made within four days of inoculation. To explain the difference in the size of galls initiated in this period and those initiated in 36 to 48 hours, it is thought that the bacteria must act for about four days for the altered cells to receive the maximum stimulation.

RIVERA (V.). **Action of contact of different metals on the development of neoplasms by 'Bacterium tumefaciens.'**—*Int. Bull. Pl. Prot.*, xvi, 10, pp. 136M–141M, 5 figs., 1942.

Continuing his studies at the University of Perugia, Italy, on the effect of contact with various metals on the agent of crown gall (*Bacterium tumefaciens*) on *Pelargonium zonale* [*R.A.M.*, xvi, p. 399], the writer confirmed the positive results secured in previous experiments, zinc in the form of a sheet inserted into the inoculation wound in particular exerting a strongly inhibitory action on the development of the neoplasms. Copper exercised a similar but less powerful influence on the pathogen, while the initially depressing effect of lead was subsequently replaced by a stimulatory one. This procedure is contrary to that observed in the case of the same metals operating at a distance from the tumours, when lead induces the strongest and most persistent reduction of growth, while zinc and copper are approximately equal in their much weaker action on *Bact. tumefaciens*.

GALLAGHER (P. H.) & WALSH (T.). **The susceptibility of cereal varieties to manganese deficiency.**—*J. agric. Sci.*, xxxiii, 4, pp. 197–203, 6 figs., 1944.

When different varieties of wheat, barley, rye, and oats were grown in pots in two soils in which oats had previously shown conspicuous symptoms of manganese deficiency [*R.A.M.*, xxii, pp. 130, 428], all these cereals developed disease symptoms, but rapidly recovered when sprayed with a 1 per cent. solution of manganese sulphate [ibid., xxi, p. 193]. Wheat was as seriously affected as oats, but in both cases there were marked differences in varietal susceptibility. Manganese greatly accelerated earing and ripening. It strongly stimulated wheat tillering. The effect of manganese treatment in these respects was in proportion to the severity of the disease symptoms shown by a particular variety. 'Blindness' in oats (reduced percentage of well-filled grain) ran parallel with susceptibility to grey speck. The evidence obtained, taken as a whole, indicated that manganese deficiency in the soil may to a large extent be overcome by the choice of a suitable cereal variety. When symptoms appear, spraying with 1 per cent. manganese sulphate solution provides an effective and economical remedy.

HARRIS (R. H.) & KNOWLES (DARLINE). **Macaroni cooking value of some North Dakota durum Wheat samples.**—*Food Res.*, viii, 4, pp. 292–298, 1 graph, 1943.

In further investigations at the North Dakota Agricultural Experiment Station on the relation of wheat blights, including 'black point' [*Alternaria* spp. and

Helminthosporium sativum], to the cooking value of macaroni [*R.A.M.*, xxii, p. 59], the cooked weight and tenderness of the processed product was found to be significantly reduced by the fungal infections. The Kubanka variety is much more resistant to 'black point' than Mindum, the percentage of injury in the former in one series of trials in 1940 being only 5 as compared with 19 in the latter.

LUDWIG (R. A.) & HENRY (A. W.). **Studies on the microbiology of recontaminated sterilized soil in relation to its infestation with Ophiobolus graminis Sacc.**—*Canad. J. Res.*, Sect. C, xxi, 11, pp. 343–350, 1 pl., 1943.

In pot experiments with steam-sterilized black soil reinoculated with the take-all fungus *Ophiobolus graminis* [*R.A.M.*, xii, p. 18], and inoculated unsterilized soil, less severe infection of wheat seedlings was found to occur in the former than in the latter. It was concluded at that stage of the study that the microflora developing in sterilized soil following recontamination has a greater suppressive action on the take-all fungus than that usually present in unsterilized soil. In further experiments it was found that the two microfloras differ both quantitatively and qualitatively. In general, determination by the plate count method showed that greater numbers of bacteria and fungi and, to a lesser degree, Actinomycetes are present in sterilized recontaminated than in unsterilized soil. *Trichoderma viride* was, in particular, predominant in the sterilized recontaminated soil, while in unsterilized it occurred only occasionally; in natural soils in Alberta, this species is widely prevalent, but not predominant to the extent found in recontaminated sterilized soil. The abundant and rapid development of *T. viride* in the latter is considered to be of special significance, and it is believed that the antagonism of this species towards *O. graminis* probably plays an important part in suppressing the latter.

GARRETT (S. D.) & DENNIS (R. W. G.). **Note on the occurrence of Ophiobolus graminis Sacc. var. avenae E. M. Turner in Scotland in 1942.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 146–147, 1943.

An extensive search, during 1942, for *Ophiobolus graminis* var. *avenae* [*R.A.M.*, xx, p. 159] in Scotland showed the fungus to be widely distributed in the counties of Ayr, Kincardine, and Aberdeen, and to be present also in Fife and Banff. The fungus was not found in the Lothians or Tweedside, where it was previously recorded by Dennis and Foister [ibid., xxi, p. 439], but crops in these districts were not examined until too late for easy detection of the disease. No search was made in other areas. Measurements made of 50 ascospores selected at random from each of the 21 collections of diseased material obtained in this survey showed the average ascospore length in the different collections to be within the range 96 to 119 μ, and the modal length to vary from 95 to 116 μ. These data are taken to substantiate Miss E. M. Turner's separation of *O. graminis* var. *avenae* from *O. graminis* proper [ibid., xx, p. 159] on the basis of differences in ascospore length as well as in host range. So far the whiteheads disease of oats has not been reported from areas other than those in which oats are the chief cereal crop. The association of the disease with consecutive oat cropping was noted by the authors in Ayr, where it is the practice to take two, and occasionally three consecutive crops of oats after ploughing up old grass. Oats infected by *O. graminis* var. *avenae* (mean ascospore length $112 \pm 1{\cdot}2\ \mu$) were discovered at Craibstone, Aberdeen, but wheat suffering from the take-all disease on another field of the same farm yielded *O. graminis* proper (mean ascospore length $71 \pm 1{\cdot}1\ \mu$). It is suggested that a careful search for *O. graminis* var. *avenae* should now be undertaken in the south and east of England and ascospore measurements made on collections of wheat and barley attacked by the take-all disease in Scotland, Wales, and the north-west of

England, with a view to establishing the susceptibility of these crops to the oats fungus in the field.

PATEL (N. B.). **Independence in inheritance of the loose smut reaction and lemma colouration in an Oat cross.**—*Bull. Inst. Agric., Anand, India,* Bot. Ser., 1, 27 pp., 1943.

A detailed, tabulated account is given of the writer's studies at Ithaca, New York, on the mode of inheritance of the characters for loose smut (*Ustilago avenae*) reaction and lemma coloration in crosses between the highly susceptible Victor (*Avena sativa*) and the very resistant Victoria (*A. byzantina*) oats, the two varieties being furnished with black and red glumes, respectively. The kernels of the dehulled seeds were inoculated with chlamydospores of physiologic race 21 of the pathogen. The F_1 progeny were resistant to smut and their spikelets were black. In the F_2, 257 plants were classed as non-susceptible, black-glumed, 102 as non-susceptible, non-black-glumed, and 107 as susceptible only (the glumes in the last-named group having been destroyed by the smut and their colour therefore indistinguishable). These observations agree with a 9: 3: 4 ratio postulated by the hypothesis that smut reaction and lemma colour are independently inherited, i.e., there is no genetic linkage between the two characters. The genes conferring resistance to *U. avenae* and black glume colour are dominant over those for susceptibility and red lemmae, this conclusion being amply corroborated by the behaviour of the F_3 offspring of the cross.

The discussion appended to the paper includes references to the nature of disease resistance in plants, the cellular or protoplasmic type of immunity, the cytology and development of *U. avenae* within the host, varietal reaction and its classification, the mechanism of disease resistance in plants, and the inter-relationship of polymerism and hexaploidy in oats.

RICHTER (H.) & MÜLLER (H.). **Der Brand der Rispenhirse (Sphacelotheca panici miliacei) und seine Bekämpfung.** [The smut of Panicle Millet (*Sphacelotheca panici-miliacei*) and its control.]—*Zbl. Bakt.*, Abt. 2, cvi, 1–4, pp. 32–37, 3 figs., 1943.

The cultivation of panicle millet (*Panicum miliaceum*) had for many years before the present crisis been practically abandoned, but it has recently been resumed in connexion with the plan for German economic self-sufficiency, in this case with special reference to fodders. The symptoms of smut (*Sphacelotheca panici-miliacei*), which has been observed to be steadily increasing with the expansion of its host, are described on the basis of the relevant literature, the titles of 32 papers being cited in the bibliography. Experiments were carried out at the Biological Institute, Dahlem, Berlin, to determine the efficacy of seed treatment in the control of the smut, two methods of inoculation with which were used, namely, (1) immersion of the seed in a 0·4 per cent. spore suspension, and (2) contamination of the soil of the seed drills with a mixture of spores and talc, resulting in 60 and 47 per cent. infection, respectively. Perfect freedom from smut was obtained by dusting with the officially approved fungicides, abavit, ceresan, germisan, and fusariol, at dosages of 300 or 400 gm. per kg. seed, while the 200 and 100 gm. rates permitted the development of a few infected panicles. Satisfactory results were also given by three forms of liquid treatment with the same preparations, viz., 30 minutes' immersion at 0·1 or 0·2 per cent., sprinkling with 15 l. of a 0·5 per cent. solution per 100 kg. and covering for one hour, and the short disinfection process at a strength of 1, 2, or 3 per cent. per 100 kg.

SMITH (M. R.). **The relationship of ants and other organisms to certain scale insects on Coffee in Porto Rico.**—*J. Agric. P.R.*, xxvi, 2, pp. 21–27, 1942.

The principal factor regulating the abundance of scale insects on coffee in Puerto

Rico, of which the most important are *Saissetia haemispherica* and *Coccus viridis*, is the development on the pests of certain entomogenous fungi, especially *Cephalosporium lecanii*. These organisms flourish in the presence of shade, coolness, and humidity, and the incidence of scale infestation is accordingly reduced in well-shaded groves. On the other hand, the insects abound during dry spells, or when the shade trees are stripped of their branches, as in the San Felippe hurricane of 1928, thereby permitting the access of sunlight to the coffee.

NEGRONI (P.). **Sobre el Paecilomyces burci (Pollacci) Thom como probable hongo entomógeno de la Mariposa.** [On *Paecilomyces burci* (Pollacci) Thom as a probable entomogenous fungus of the Butterfly.]—*Rev. Inst. bact., B. Aires*, xi, 3, pp. 265–267, 2 pl., 1943. [French and English summaries.]

A dead pupa of a butterfly from Lomas de Zamora, Buenos Aires, was covered with the white coremia, 4 to 5 by 0·4 to 0·5 mm., of a fungus, which was cultured on Czapek's agar and identified on the basis of its sterigmata, 5·2 to 15·1 by 1·8 to 3 μ, as *Paecilomyces burci* (Pollacci) Thom. The conidiophores are 2·2 to 3 μ in diameter and the elliptical, concatenate conidia 4·5 to 7·5 by 3 μ. Attention is further drawn to the claviform, slightly arcuate, relatively thick-walled, pigmented, pedunculate, vegetative organs, separated by a septum from the rest of the mycelium, the function of which is obscure. On the above-mentioned medium the colonies after 15 days at 25° C. measure 2·5 cm. in diameter; they are plicate, pubescent, some zonate and fleecy, others chamois-coloured, the reverse side being plicate and of an orange tint. On beer wort agar the growth is fleecy, chamois-coloured at the centre and white at the periphery, the reverse side as on Czapek's.

MELVILLE (R.) & DADE (H. A.). **Chalk brood attacking a wild Bee.**—*Nature, Lond.*, cliii, 3873, p. 112, 1944.

In the nest of a leaf-cutting bee, probably a species of *Megachile*, in a piece of deal from Acton, the pupa and pollen store were found to contain *Pericystis apis*, the pathogen causing the chalk brood disease of honey bees [*R.A.M.*, ix, p. 524]. There does not appear to be a previous record of this fungus on wild bees.

STUHR (E. T.), CHRISTENSEN (B. E.), & WONG (E.). **Assay of Oregon ergot.**—*J. Amer. pharm. Ass.*, Sci. Ed., xxxii, 9, pp. 241–244, 2 figs., 1943.

Existing world conditions have necessitated the investigation of potential sources of ergot (*Claviceps purpurea*) supply within the United States. The fungus is commonly present on grasses in the range land of south-eastern Oregon, the extent of infestation, however, fluctuating from one year to the next. In 1940 and 1941 the disease was prevalent on the giant wild rye [*Elymus condensatus*], blue joint [*Calamagrostis canadensis*], and Nevada blue [*Poa nevadensis*] grasses in Harney County. The samples assayed by colorimetric and biological methods induced typical physiological reactions, while the fluid extract possessed a strong potency.

COLHOUN (J.). **Grey mould (Botrytis cinerea) of Flax.**—*Nature, Lond.*, cliii, 3870, pp. 25–26, 1944.

When clean flax seed was dipped in a spore suspension of *Botrytis cinerea* from flax seed, and the inoculated seed was placed in pots of moist, sterilized soil covered with bell jars, a few days after the cotyledons had appeared, some of the seedlings showed brownish lesions on the hypocotyl and afterwards developed damping-off. Seedlings from uninoculated seed remained healthy, provided the bell jars were not removed.

Seed treatment with nomersan [*R.A.M.*, xxii, p. 359] at the rate of 12 oz. per cwt., or with ceresan U564, using an 8 per cent. solution at the rate of 0·9 gal. per cwt., reduced contamination with viable *B. cinerea* from 15 per cent. in the control to 0·4 and 1·4 per cent., respectively, in 1942, and from 13·1 per cent. to 1·2 and 1·6 per cent., respectively, in 1943.

In pot experiments in a greenhouse and under an open outdoor verandah very satisfactory control of the disease resulted from the use of nomersan and ceresan U564. In field tests, similar results were obtained, though in the trials made in 1942 the disease was early checked by cold, dry weather, whilst in 1943 it did not appear, owing probably to the cold weather following sowing.

Observations in the field showed that *B. cinerea* is able to kill portions of the stems of mature plants; it is, also, often present on the stems and capsules if long periods of damp weather occur after the crop has been pulled.

HAWKER (LILIAN E.). **Notes on basal rot of Narcissus. I. A comparison of various methods of using formalin in connection with the hot-water treatment against Eelworm. II. Infection of bulbs through dying roots in summer.**—*Ann. appl. Biol.*, xxx, 4, pp. 323–324, 325–326, 1943.

In three years' large-scale experiments to determine the best method of using formalin (against *Fusarium bulbigenum*) [*R.A.M.*, xix, p. 539; xxi, p. 335; xxii, p. 169] in the hot-water treatment of narcissus bulbs, it was found that the bulbs infected with *F. bulbigenum* showed equally good control whether formalin (0·5 per cent.) was used in the bath (three hours at 42° to 43° C.) or as a cold or warm steep immediately afterwards. For example, in one lot of 140 Victoria bulbs given the hot water treatment 85 rotted, whereas only two rotted when formalin was added to the bath, and only four when cold formalin steep followed immediately on the hot-water treatment; in another test with 80 Victoria bulbs, the corresponding figures were 57, 10, and 7, while in one with 50 Golden Spur they were 5, 0, and 0, respectively. Delayed formalin treatment gave less control in four out of five trials.

No damage to leaves or flowers was caused by any treatment applied in late August, the period of maximum dormancy. In the one experiment (Seagull variety) in which bulbs were treated at other times, treatment in July caused roughening of the leaf surface, splitting of the flowers, and accelerated flowering, while treatment in September resulted in blind buds. This injury was caused by the hot-water treatment, and was independent of the use of formalin.

In experiments with about 5,000 healthy bulbs belonging to six varieties, no treatment had any significant effect on either average date of flowering or amount of gain in weight during the next growing season. It is concluded that formalin may be added directly to the hot-water bath or used as a warm or cold steep immediately after with equally good results, but losses from basal rot may ensue if the formalin treatment is delayed.

When the roots of the susceptible varieties Spring Glory, Victoria, and Golden Spur were exposed in May or June and a culture of *F. bulbigenum* was scattered over them and the soil then replaced, a high percentage of infection followed only when the soil was wet at and after the time of inoculation. Cool weather delayed infection. Bulbs planted during autumn in experimentally or naturally infected soil gave a complete stand in spring, but later developed heavy losses from basal rot. In the author's experience, infection of a clean stock from the soil arises only when an affected stock was grown in the same plot before, or when the soil has been artificially contaminated. If the fungus is, in fact, a soil inhabitant, then under English conditions, either it is not present everywhere, or, if it is, it is present only in small amounts.

HAWKER (LILIAN E.) & SINGH (B.). **A disease of Lilies caused by Fusarium bulbigenum Cooke & Mass.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 116–126, 1943.

A disease of lilies, causing serious losses, was observed during 1939 on seedlings of *Lilium auratum*, *L. sargentiae*, *L. nobilissimum*, *L. regale*, and on bulbs of a hybrid lily. The first symptom is a slight wilting of the leaves and a reddish-brown root rot usually beginning at the tips; later leaves become yellow and stunted, the roots decay entirely, the rot spreading into the bulb scales, the outer ones being attacked first. Diseased areas are clearly demarcated from healthy ones, the lower portions of the scales being completely rotted while the upper ones remain white, though some bulbs are wholly rotted. Isolations from diseased tissue yielded a fungus identified as *Fusarium bulbigenum*, the identification being confirmed by Miss E. M. Wakefield. The organism resembled the strain isolated from *Narcissus* bulbs with basal rot [*R.A.M.*, xix, p. 539]. Inoculation experiments demonstrated that the fungus is capable of infecting unwounded roots of *L. regale* and of seedling lilies, but not unwounded bulb scales. The strain from *Narcissus* caused infection of wounded bulb scales, but the rotting was slower than that caused by the strain from lily. Inoculation of autoclaved soil with infested soil from the vicinity of diseased seedlings or with sand or maize meal cultures of the lily strain of the fungus resulted in a high incidence of both pre- and post-emergence damping-off of lily seedlings, while the strain from *Narcissus* caused less heavy losses. Old isolations of the lily strain were less virulent than fresh ones. Infection and losses were also caused by watering the seed boxes with a suspension of spores of *F. bulbigenum*. Good but not complete control was achieved by adding formalin dust (0·5 per cent. by weight) to the soil in seed boxes before sowing, and some protection resulted from treating the soil in frames with liquid formalin before planting, or watering the growing seedlings with a weak solution of uspulun.

LOUW (A. J.). **Mottle leaf or mosaic chlorosis of Apples.**—*Fmg S. Afr.*, xix, 214, pp. 32–34, 44, 1 fig., 1944.

Apple trees in South Africa have for many years past been subject to a mottle leaf or mosaic type of chlorosis, which appears to be spreading. In a preliminary survey carried out in Ceres and Elgin, no apple orchard was found to be entirely unaffected, and in every orchard examined nearly all trees of the Golden Delicious variety were attacked.

The most conspicuous symptom is the presence of numerous blotches on the leaves. In spring and early summer, the blotches are white, while on leaves developing in late autumn they are often yellow. Sometimes, the greater part of the leaf is white, with a narrow band of green adjoining the larger veins; in other areas, chlorosis is present only along the larger veins, while the rest of the leaf remains green. In some leaves, only the serrated border is chlorotic. In summer, the chlorotic blotches tend to dry out, after which the leaves drop, severely affected trees becoming almost completely defoliated by midsummer. All the leaves on a shoot may bear blotches, but as a rule normal leaves are found among affected ones on the same shoot. No symptoms are present on the fruit.

The condition was not found to be associated with nutrient deficiencies. It was readily transmitted by grafting or budding. When healthy trees are grafted or budded with diseased material, typical mosaic leaves develop on the rootstock, even when the infected bud is not allowed to run out. The disease is also transmitted by buds from the axils of the apparently healthy leaves from affected trees, as well as by grafting bark strips from affected trees on to healthy ones. The initial movement of the virus appears to be towards the roots.

The condition was experimentally transmitted to the varieties Apple of Commerce, Cleopatra, Golden Delicious, Granny Smith, Ohenimuri, Red Delicious, Rokewood, Rome Beauty, Versveld, and White Winter Pearmain. Preliminary observations suggest that the virus is spreading most rapidly in Golden Delicious, Ohenimuri, and White Winter Pearmain.

In old orchards, severely affected trees are frequently lacking in vigour and produce small crops of poor fruit. While it is not feasible to destroy affected trees, the prevalence of the disease will be much reduced if only trees free from mosaic are used for new plantings. Budwood and scions must not be taken from affected trees, and nurseries practising root-grafting should take the same precautions in selecting root-grafts. Where stub-grafting is applied, the likelihood of infection is greatly increased. Growers who intend to buy trees for new plantings should inspect the nursery during the summer, when the trees are still in full leaf.

JAUCH (CLOTILDE). **La presencia de 'Cylindrocladium scoparium' en la Argentina.** [The presence of *Cylindrocladium scoparium* in Argentina.]—*Rev. argent. Agron.*, x, 4, pp. 355–360, 2 pl., 2 figs., 1943. [English summary.]

Cylindrocladium scoparium has recently been observed to attack apricots, yerba-mate [*Ilex paraguayensis*], on which the first collection was made by J. B. Marchionatto, *Eucalyptus* [*R.A.M.*, xxii, p. 505], and roses in various parts of Argentina. The fungus produces on apricot stems, at or just below soil-level, necrotic lesions which rapidly girdle the infected part and kill the seedlings. On *I. paraguayensis* leaves the ill-defined, black, zonate, centrally sunken spots measure 3 to 25 mm. in diameter. *Eucalyptus* seedlings are invaded through the collar, which is girdled and rotted by the dark-coloured lesions of the pathogen. The leaves sometimes bear indefinite, roughly circular, ochraceous-buff spots (grey on *E. cinerea*), 1·5 to 15 mm. in diameter. The juncture of stock and scion is the usual channel of infection on roses, which develop a black discoloration and fissures on the cortex.

C. scoparium was isolated on potato dextrose agar and inoculated into the above-mentioned hosts with positive results (through wounds only in the case of *I. paraguayensis*). The following species of *Eucalyptus* were infected: *E. globulus*, *E. rostrata*, *E. viminalis*, *E. resinosa*, and *E. cinerea*. In cross-inoculation tests the strains from the various hosts were mutually pathogenic.

DEMAREE (J. B.) & WILCOX (MARGUERITE S.). **The fungus causing the so-called 'Septoria leaf spot disease' of Raspberry.**—*Phytopathology*, xxxiii, 11, pp. 986–1003, 2 figs., 1943.

The fungus responsible for the so-called '*Septoria*' leaf spot of red and black raspberries prevalent in the United States east of the Rocky Mountains has been known for nearly a century as *S. rubi* Westendorp, and more recently as *Mycosphaerella rubi* (West.) Roark [*R.A.M.*, xvii, p. 190]. To the same organism has been attributed a similar disease of blackberry and dewberry occurring throughout the country. Examination of the type collection of *Cylindrosporium rubi* Ell. & Morg., 1885, showed it to be identical with the common raspberry fungus hitherto known as *S. rubi* West., 1854. The writers' latest investigations have shown the ascigerous stage of the raspberry pathogen to be a *Sphaerulina* which is named *S. rubi* n.sp., while no perfect phase of the blackberry and dewberry fungus could be detected in overwintered foliage.

S. rubi in the previous year's leaves of *Rubus strigosus* is characterized by numerous scattered or gregarious, mostly hypophyllous, erumpent, black, conical, ostiolate-papillate perithecia, 88 to 140 by 86 to 120 μ; and fasciculate, clavate-cylindrical, sessile, curved or straight, aparaphysate asci, 70 to 44·8 by 9·6 to 15 μ, containing eight hyaline, granular, cylindrical, mostly curved, normally 4-,

occasionally 6- to 8-celled ascospores, 32 to 57·6 by 3·5 to 5·8 μ, pointed at both ends. The fungus in its pycnidial state, *Cylindrosporium rubi* Ell. & Morg. (emend.), reported by Zeller (*Plant Dis. Reptr*, xxvi, p. 329, 1942), is the agent of widespread damage to red raspberries in Pennsylvania, producing on living leaves circular to angular, greenish-black, later greyish spots, 1 to 2 or up to 4 to 6 mm. in diameter. The epiphyllous, subepidermal, thin-walled pycnidia measure 58 to 80 by 58 to 121 μ, and the elongated, obclavate, slightly curved to falcate, hyaline, 3- to 9-septate pycnospores, pointed at one end, 32 to 86 by 3 to 4·8 μ. The name *Septoria darrowii* [*R.A.M.*, xvii, p. 828], apparently used by Zeller in describing the raspberry fungus, is regarded by the authors as a synonym of the earlier *C. mali*. From the descriptions it would appear that *S. rubi* B. & C., *S. comitata* J. J. Davis, and all vars. of *S. rubi* as well as *Ascochyta rubi* Lascher, *Rhabdospora ramealis* (Desm. & Rob.) Sacc., and *Sphaerella ligea* Sacc. are all synonyms of *Septoria rubi* West.

The optimum temperature for growth is 27° C. In greenhouse inoculations the raspberry isolates were non-pathogenic to blackberry and dewberry leaves, those from the Lucretia dewberry infected their own host and the Lawton blackberry but not raspberry, while the blackberry strains attacked the same host readily, dewberry with moderate severity, and the raspberry only with difficulty. The isolates, whether regarded as distinct species, physiologic races, or strains, from each of the three hosts, differ morphologically and physiologically among themselves, retaining their separate identity even if capable of infecting another host. The most striking differences were observed between the raspberry and dewberry forms, the blackberry strain being intermediate between the other two.

Pending the availability of more substantial proof of relationship of the leaf-spotting fungi from raspberry, blackberry, and dewberry, it is proposed to retain the binomial *S. rubi* West. (*M. rubi*) for those from the two last-named, *Sphaerulina rubi* n.sp. being restricted to the raspberry.

Reid (R. D.). **Strawberry red core disease. A progress report.**—*Fruitgrower*, xcvii, 2508, pp. 9–10; 2509, pp. 29–30, 1 fig., 1944.

For several seasons strawberry red core [*Phytophthora fragariae*] caused relatively little trouble in Scotland, but in 1943 it again became of major importance and was responsible for heavy losses in many commercial plantations. The resistance of the Auchincruive group of varieties [*R.A.M.*, xx, p. 482], which probably occupy some 75 per cent. of the total area under strawberries in the west of the country, broke down to some extent under the very exacting weather conditions, notably in respect of the saturated condition of the soil induced by the heavy rainfall during the five months from December, 1942, to April, 1943 (18·03 in. on 106 days out of a total of 151 as against 10·64 on 86 days in the corresponding period of 1941–2). A similar observation was made in the United States in respect of the resistant American Aberdeen (*Plant Dis. Reptr*, xxvi, p. 291, 1942). They do, however, continue to crop where other varieties are a complete failure. A large pool of very promising seedlings, mostly derived from American Aberdeen with a considerable admixture of *Fragaria chiloensis* and *F. virginiana*, has been produced for testing and as future breeding material.

Attempts to solve the problem of virus disease in strawberries by breeding from the tolerant *F. chiloensis* gave disappointing results, inasmuch as the few seedlings that fruited satisfactorily proved highly susceptible to *P. fragariae*, and success in this direction cannot be expected in the immediate future.

Wormald (H.). **Nut drop: a disease of cultivated Hazel Nuts.**—*Gdnrs' Chron.*, Ser. 3, cxv, 2980, pp. 60–61, 2 figs., 1944.

Monilia [*Sclerotinia*] *fructigena* was isolated on prune agar from the discoloured

kernels of prematurely fallen cobnuts [*Corylus avellana*] from a farm near Sevenoaks, Kent, submitted for inspection to the East Malling Research Station in July, 1943, and inoculated with positive results into apple and plum fruits. However, since a rot of these fruits was also caused by other fungi from the same samples of nuts, *S. fructigena* cannot be definitely implicated as the primary agent of the disease pending further comparative studies. The diseased nuts showed discoloured, somewhat withered cupules and browning of the shells, particularly at the base. The loss caused to the grower concerned was from 50 to 95 per cent. in recent years, the dropping occurring in July and August. *C. avellana* does not appear to have been previously reported as a host of the brown rot fungus in England, but Sorauer described the disease on hazel nuts in Germany in 1887 (*Z. PflKrankh.*, x, pp. 152–154, 1900), and it has since been observed in Sweden (1911–1912) and Austria (1922). Since cobnuts are almost invariably grown on fruit farms, the possibility of their serving as sources of infection for pome and stone fruits must be borne in mind.

Gorter (G. J. M. A.). **A leaf-spot disease of the Olive.**—*Fmg S. Afr.*, xviii, 212, pp. 795–798, 801, 3 figs., 1943.

Olive trees on the experimental farm at Elsenburg, South Africa, have in recent years suffered from leaf spot (*Cycloconium oleaginum*) [*R.A.M.*, xxi, p. 403] which, by causing serious defoliation, has appreciably reduced yields. The disease, very probably, also occurs in other groves in the western Cape Province. Usually, the symptoms are most conspicuous during spring, just before the trees begin to blossom. A high percentage of the leaves on affected trees then show yellowing, and bear circular green spots, mostly 3 to 5, but sometimes up to 10 mm. in diameter. Close examination of apparently normal leaves often discloses the presence of spots 2 to 5 mm. in diameter, darker green than the surrounding tissue. At a later stage, the centre of such spots, which develop only on the upper surface of the leaves, usually becomes chlorotic. The spots are surrounded by a zone of slightly discoloured tissue about 0·5 mm. wide. The affected leaves quickly become chlorotic, the spots, which remain green, contrasting sharply with the surrounding tissues. The tissue in the spots is occasionally necrotic. In summer, the spots may turn black. Yellowed leaves drop relatively early.

The Mission and Oblizia varieties appear to be very susceptible, while Manzanillo and Sevillano are moderately resistant, and Nevedillo Blanco is strongly so.

Spraying tests so far conducted indicate that good results are obtained by thorough spraying with Bordeaux mixture (4–4–50) early in winter, after the crop has been picked, followed by another treatment (4–4–100) in spring, directly the young leaves develop, and when flowering is almost over. Fallen leaves should be ploughed under. Only resistant varieties should be planted in new groves. The variety, Leccina, imported from South America, is presumably identical with the resistant European variety under this name.

Sen (P. K.). **Further studies on 'black-tip' of the Mango.**—*Sci. & Cult.*, viii, 2, pp. 91–92, 2 figs., 1942.

Further support is lent to the hypothesis that the fumes from brick kilns are responsible for mango 'black tip' by recent experiments at the Fruit Research Station, Sabour, Bihar, India [*R.A.M.*, xxiii, p. 69], which also yielded the following information. In whatever position the fruit is held, the disorder invariably originates at the tip. The discoloration develops exclusively during the period of active growth of the fruits (24th April to 3rd May in 1942). Fruits exposed to the fumes after attaining their full size but still remaining green (14th to 28th May) did not turn black, but tended to mature earlier than the controls.

Irons (F.). **A laboratory study of crop duster problems.**—*Agric. Engng*, xxiv, 11, pp. 383–384, 3 figs., 3 graphs, 1943.

Economic control of plant diseases and pests on many field crops depends on the efficient performance of the dusting mechanism, problems connected with which have become more troublesome of recent years through the introduction of new combinations of material applicable only with difficulty, while at the same time entomologists and plant pathologists are setting increasingly rigid and exacting standards for the working of the machinery. The results of the writer's laboratory studies on multiple-outlet power dusters indicate that new developments and improvements in design are needed to surmount certain difficulties connected with unreliability and lack of uniformity in feed rate control, distribution, and fractionation.

Wain (R. L.) & Wilkinson (E. H.). **Studies upon the copper fungicides. VI. The solution of copper from Bordeaux and Burgundy mixtures.**—*Ann. appl. Biol.*, xxx, 4, pp. 379–391, 1 graph, 1943.

Further studies on the copper fungicides [cf. *R.A.M.*, xxii, p. 147] showed that the soluble copper in freshly prepared Bordeaux mixture (4–4–50) was of the order of 7 p.p.m., but on standing in the absence of air this fell to 0·7 p.p.m. after 10 days. The dried deposit on glass plates yielded about 0·5 p.p.m. of copper to water. As alkalinity increased, the soluble copper in freshly prepared Burgundy mixtures fell to a minimum of about 3 p.p.m., and then rose. This was not the case with dried deposits, which yielded consistently less copper to water. The amounts of copper dissolved by water from dried Bordeaux mixture (4–4–50) deposit on leaves of runner beans were slightly greater than those obtained from the same deposit on glass plates.

Suspensions of *Neurospora sitophila* spores and their filtrates dissolved copper from dried Bordeaux mixture (4–4–50) deposit in excess of the amount dissolved by water. Steam sterilization of spore filtrates did not greatly affect their ability to dissolve copper from dried Bordeaux mixture. The temperature at which spores were suspended in water was a factor, though the substances able to dissolve copper were rapidly yielded to water. The nutrient agar on which the fungus was grown influenced the amount of soluble solids in the spore filtrate and the ability of the filtrates to dissolve copper from dried Bordeaux deposit.

Copper, it was found, could only dissolve from dried 4–4–50 Bordeaux deposit by a mechanism involving complex formation. Active substances included amino-, hydroxy-, and certain dicarboxylic acids and their salts, all being possible constituents of spore exudate. Such substances did not appear to be involved in the liberation of soluble copper from this fungicide.

The hypothesis is put forward that copper dissolves from the deposit under the influence of excretions from the spore, and that the cupri-complexes produced provide the means by which soluble copper is transported to the spore wall. Dissociation of these complexes then render possible the removal of the active toxicant by the spore, with the result that any reversible reactions involved are enabled to continue.

Parker-Rhodes (A. F.). **Studies in the mechanism of fungicidal action. VI. Water.**—*Ann. appl. Biol.*, xxx, 4, pp. 372–379, 2 figs., 1943.

In this paper [cf. *R.A.M.*, xxii, p. 101] the author presents a number of theoretical deductions from application of the theory of variability to hydration effects, dealing with the effect on variability of a given population of spores to acid and alkali toxication of varying the isotopic composition of the hydrogen. In the case of acid toxication, variability should decrease with increasing deuterium content, while in that of alkali toxication it should increase. Experimental evidence con-

firmed this. The importance of hydration effects in practice is emphasized, and evidence is adduced that non-toxic electrolytes exert a direct desolvative action on hydrogen-ions.

McCallan (S. E. A.). **Empirical probit weights for dosage-response curves of greenhouse Tomato foliage diseases.**—*Contr. Boyce Thompson Inst.*, xiii, 4, pp. 177–183, 2 graphs, 1943.

This paper is a further contribution to the series on the mathematical interpretation of the method of evaluating fungicides by means of tomato foliage disease tests [*R.A.M.*, xxiii, p. 34]. When the number of infections is expressed as a percentage of the control, there is a linear relation between probit disease and logarithm of dose but orthodox probit weights are not applicable. In the present study probit weighting coefficients were obtained empirically from 431 pairs of replicate tomato plants infected with early [*Alternaria solani*] or late blight [*Phytophthora infestans*]. By the use of the linear regression equation, a highly significant regression coefficient was found between the logarithm of the weight of per cent. disease in replicate plants and the logarithm of the mean per cent. disease. There was no difference between the early and late blight regression coefficients, although the weights for late blight were more than three times as great as those for early blight. The final probit weights (which are shown in a figure and a table) were derived from the per cent. weights by multiplying by the appropriate z^2 value as obtained from a table of ordinates of the normal curve. The maximum weight is approximately at probit 3·8 equivalent to the LD 88. There is little difference within the range LD 80 to 95, but beyond this range the weights diminish with increasing rapidity. It is recommended that in the use of this greenhouse method of testing fungicides, comparisons of dosage for equal response should be made at the LD 95 level.

Quanjer (H. M.). **Phytopathologische terminologie, met speciale bespreking van den begrippen biotrophie, premuniteit en antistoffen.** [Phytopathological terminology, with a special discussion on the concepts biotrophy, premunity, and anti-substances.]—*Tijdschr. PlZiekt.*, xlviii, 1, pp. 1–16, 1942. [Abs. in *Z. PflKrankh.*, liii, 4–7, p. 200, 1943.]

The author associates himself with the endeavours of the Committee on Technical Words of the American Phytopathological Society in the provision of more accurate definitions of the concepts underlying such technical phytopathological terms as 'host', 'susceptibility', 'non-susceptibility', 'resistance', 'disease-escaping', 'sensitivity', 'non-sensitivity', 'tolerance', 'hypersensitivity', 'necrotic abortion', 'pathogen', 'pathogenicity', 'infection', 'infect', 'infectious', 'inoculate', 'infested', and 'infest'. The sense attached to 'disposition', 'masking', 'perthotrophy', 'necrotrophy', 'tryptotrophy', 'mesotrophy', 'subinfection', 'incubation', 'viruliferous', and 'circulation period' is amplified or modified. Innovations in the way of technical terms are 'biotrophy', implying the phase of a parasitic or pathogenic agency during which the disease-producer draws its nutriment from the living host cells, and 'premunity', expressing the loss of susceptibility in a plant, after partial or total infection by a virus or parasite, to the particular pathogen in question or a related one. 'Premunity' thus corresponds broadly with Doerr's 'immunity bound to infection'. The definitions are given in Dutch and English.

Aerobiology.—*Publ. Amer. Ass. Advanc. Sci.* 17, vii+289 pp., 10 pl., 34 figs., 21 diags., 17 graphs, 2 maps, 1942. $4.00.

This symposium on aerobiology contains a number of critical discussions and reviews of the literature on subjects of phytopathological and mycological interest.

They comprise 'The field of extramural aerobiology' by E. C. Stakman (pp. 1–7); 'Air-borne fungus spores as allergens' by O. C. Durham (pp. 32–47, 2 graphs, 2 maps); 'Micro-organisms in the upper air' by B. E. Proctor and B. W. Parker (pp. 48–53); 'Micro-organisms in marine air' by C. E. Zobell (pp. 55–68, 1 fig., 1 graph); 'Local aerial dissemination of plant pathogens' by G. W. Keitt (pp. 69–77); 'Long distance dissemination of plant pathogens' by J. J. Christensen (pp. 78–87); and 'Abiotic and sublethal effects of ultra-violet radiation on micro-organisms' by A. Hollaender (pp. 156–165, 1 diag., 6 graphs). Reference to all the problems under investigation has been made from time to time in this *Review*.

Larter (L. N. H.) & Martyn (E. B.). **A preliminary list of plant diseases in Jamaica.**—*Mycol. Pap. Imp. Mycol. Inst.* 8, 16 pp., 1943. 2*s.* 3*d.*

This preliminary list of diseases of economic plants in Jamaica is largely based on information which has accumulated in Departmental records since 1911. The list is arranged alphabetically under the common names with an index of the Latin names of hosts and parasites. Major diseases not so far found in Jamaica are listed in the introductory note.

Measurement of plant diseases in the field.—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 172–173, 1943.

On the basis of experience gained during 1941 and 1942, the Plant Pathology Committee of the British Mycological Society recommends the following methods of recording disease quantitatively in the field [*R.A.M.*, xxii, p. 365]. In the case of virus diseases of potato and sugar beet, where 1 per cent. or less disease is present in a crop, it is usually sufficient to estimate by visual examination according to a table supplied, one affected potato plant in a 12-yd. radius or one sugar beet plant in a 7-yd. radius representing 0 to 0·1 per cent. disease, and one affected potato plant in a 4-yd. radius or one affected sugar beet plant in a 2-yd. radius representing 0·1 to 1 per cent. disease. If more than 1 per cent. disease is present, random samples on each of two diagonal traverses of the field should be taken, five random samples of 50 to 100 plants each being adequate for general survey purposes and twice the number for special objects, such as the certification of crops. The actual method of counting can be left to the individual observer, provided that it is done consistently from the random sampling position.

Cereal smuts, and take-all (*Ophiobolus graminis*), eye spot (*Cercosporella herpotrichoides*), and brown root rot (*Fusarium* spp.) of cereals as far as they cause whiteheads, can all be recorded from the same traverses of the field. Visual estimation may be applied where percentage of disease is low, less than one affected head in 50 sq. yds. representing 0 to 0·01 per cent. disease, less than two affected heads in 1 sq. yd. 0·01 to 1·0 per cent., and more than two heads in the same area above 1 per cent. At higher percentages of disease, counts should be made by taking ten grab samples at random on a zig-zag or diagonal traverse of the crop, each sample containing not less than 20 eared tillers. The stem bases of the 200 or more eared tillers thus collected which show whiteheads should be separated into three groups, according as they are attacked by *O. graminis*, *C. herpotrichoides*, or *Fusarium* spp., and the percentage number of tillers substantially affected calculated for each group. The amount of smut present can be determined from the numbers of ears affected and may also be estimated by counts of suitable samples when the crops are in stock.

Ainsworth (G. C.) & Bisby (G. R.). **A dictionary of the fungi.**—viii+359 pp., 10 pl., Imperial Mycological Institute, 1943. 20*s.* (or $4.60).

The authors' aim in this work has been to list all the generic names of fungi

(Eumycetes and Myxothallophyta, but excluding bacteria and lichens) which were in use up to the end of 1939, later genera being enumerated in the Supplements to the *Review of Applied Mycology.* A taxonomic position for each genus is indicated, together with the distribution and number of its species. Other features include short accounts of the chief families, orders, and classes of fungi, and of the bacteria and lichens; explanations of mycological terms; the common and scientific names of important fungi; concise biographical statements concerning some of the pioneers of mycological research; and various further points of interest to workers in systematic and applied mycology and plant pathology. In the hope of extending the scope and enhancing the value of the dictionary, the text has been written for the most part in Basic English with the addition of international scientific words.

CHAIN (E.) & FLOREY (H. W.). **Penicillin.**—*Endeavour*, iii, 9, pp. 3–14, 2 pl., 1944.

A clear and full account is given in semi-popular terms of the discovery of penicillin and its chemotherapeutic properties. A bibliography of 53 titles is appended.

Penicillin, 1929–1943.—*Brit. med. Bull.*, ii, 1, pp. 1–28, 7 figs., 1944.

This issue contains special contributions by Professor L. P. Garrod (Penicillin: its properties and powers as a therapeutic agent), Professor A. Fleming (The discovery of penicillin) [see preceding abstract], Dr. E. Chain and Professor H. W. Florey (The discovery of the chemotherapeutic properties of penicillin) [see next abstract], Professor A. Fleming (Penicillin for selective culture and for demonstrating bacterial inhibitions), Dr. E. Chain (Other antibacterial substances from bacteria and moulds), and Dr. M. E. Florey (Clinical uses of penicillin), followed by a review of selected papers written between 1929 and 1943, inclusive. Communications on penicillin published abroad are listed in an appendix.

FLOREY (H. W.). **Penicillin: its development for medical uses.**—*Nature, Lond.*, cliii, 3871, pp. 40–42, 1944.

The development of penicillin research [*R.A.M.*, xxi, p. 248 and preceding abstracts] is traced from the discovery, by Prof. A. Fleming in 1929, of that substance in cultures of *Penicillium notatum* to the work being done at present at the School of Pathology, Oxford.

YOUNG (E. L.). **Studies on Labyrinthula. The etiologic agent of the wasting disease of Eel-grass.**—*Amer. J. Bot.*, xxx, 8, pp. 586–593, 2 figs., 1943.

In cultural studies of the *Labyrinthula* (the identity of which with *L. macrocystis* Cienkowski 1867 was established) [*R.A.M.*, xxi, p. 298] causing wasting disease of *Zostera marina* in Plymouth Harbor, Massachusetts, the author suspended portions of recently invaded host tissue in a hanging drop of Berkfeld filtered sea water on a cover slip supported by a wet cardboard cylinder. On incubation the parasite soon emerged into the water and by storing at 3° C. when not in use, the cultures, though contaminated by bacteria, could be maintained in good condition for at least a week. Both in the host tissue and in culture the parasite appears in its characteristic vegetative stage as a net-plasmodium with a lacy network of filamentous tracks on which the fusiform cell bodies glide. The cell bodies or spindles average 18 by 4 μ, and reproduce by binary fission with a shifting line of cleavage. The glutinous, elastic, fibrillar track is a product of the spindles, which glide along its surface. Nutrition occurs, apparently, by extracellular digestion and absorption of the foodstuffs in solution. Other stages occurring in both host tissue and hanging drop culture are an encysted phase in which individual fusiform cells round up, acquire a tough, opaque wall and presumably act as resting bodies, and a sorus stage in which several to hundreds

of cells encyst, becoming enclosed in a tough, opaque membrane; on germination the membrane breaks, liberating small, globular cells which elongate to the fusiform cells and these reconstitute the net-plasmodium. In hanging drop cultures only, a pseudoplasmodium phase also arises in which the spindles lose their fibrillar track system and mass together.

The optimum temperature range is 14° to 24° C., but viability is retained from 0·3° to 30°. Growth takes place in cultural environments ranging from P_H 4 to 9, while the salinity tolerance is from 0 to over 32 per cent. chlorinity, with an optimum range for parasitism on *Zostera* of about 12 to 22 per cent. chlorinity. The host range includes representatives from the green, brown, and golden algae, and in the Naiadaceae includes *Ruppia* and *Zannichellia*.

As *Zostera* fructifies when the surrounding water is at 18° to 24° and the fungus is most active at 14° to 24°, the host becomes blighted just before propagation. Decrease in salinity round *Zostera* beds would tend to inhibit infection and increase to favour it, since the vegetative stage of *L. macrocystis* is injured more rapidly by decrease than by increase in the salinity of the organism's environment. Observations have confirmed this view. Owing to its wide natural host range, *L. macrocystis* may be omnipresent, waiting but for the ideal ecological or physiological condition to effect invasion.

The six species of *Labyrinthula* so far described are tentatively reduced to three, with two varieties, and it is suggested that further investigation may reduce these to one species.

[In a footnote the author states that a complete account of the *Zostera* wasting epidemic is given in a Thesis for Honors in Biology filed at the Cryptogamic Laboratories, Harvard University.]

SĂVULESCU (T.). **Plant protection and phytopathological organization in Rumania.** —*Int. Bull. Pl. Prot.*, xvii, 6, pp. 85M–102M, 1943.

In a lecture given at the International Institute of Agriculture in June, 1943, the author described in detail the plant protection and phytopathological services in Rumania, and some of the disease control campaigns carried out during recent years. In particular, reference was made to the barberry eradication compaign against black rust of cereals (*Puccinia graminis*), which caused losses of 60 to 80 per cent. of the crop in 1932 and 1933; the compulsory control of wheat bunt (*Tilletia caries* and *T. foetida* [*R.A.M.*, xxi, p. 279; xxii, p. 14]) by organic mercurial dusts (of which 70 car loads were used in 1942); the establishment of stations for the hot-water treatment of cereals against loose smuts (*Ustilago tritici* and other species); the spray warning service for the control of vine downy mildew [*Plasmopora viticola*: ibid., xviii, p. 782]; the inspection of nurseries; the regulation of the sale of fungicides; and the agricultural information services. In conclusion, the author suggested several problems capable of solution only on an international scale, such as the control of cereal rusts and, in particular, those of wheat; and the preparation of maps showing the geographical distribution of the most important parasites [ibid., xxiii, p. 80].

RANZI (F.). **Two processes for preserving small animals, herbarium material, phytopathological specimens, etc.**—*Int. Bull. Pl. Prot.*, xvi, 6, pp. 86M–89M, 1 fig., 1942.

The writer has secured excellent preservation of insect and plant (including phytopathological) specimens by enclosure in successive layers of dammar resin [derived from various Pinaceous trees of the genus *Dammara*, especially *D. alba*, in Australasia and the East Indies] or between sheets of cellophane sealed at the edges with an adhesive, the air enclosed being expelled by placing the whole in a press. Application has been made for patents for these processes.

Schaede (R.). **Die pflanzlichen Symbiosen.** [Plant symbioses.]—viii+172 pp., 153 figs., Jena, G. Fischer, 1943. RM. 10. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 1–4, p. 51, 1943.]

Included in this treatise on plant symbioses are sections on the associations between Actinomycetes and *Alnus*, *Casuarina*, *Coriaria*, *Elaeagnus*, *Hippophaë*, and *Myrica* [*R.A.M.*, xviii, p. 335], the mycorrhiza of carbohydrate-autotrophic and -heterotrophic plants, and the fungal symbionts of *Lolium* [ibid., xxii, p. 138].

Rayner (M. C[heveley]). **The use and significance of composts in forestry.**—*Ann. appl. Biol.*, xxx, 4, pp. 397–399, 1943.

Reviewing her investigations into the effect of composts on the growth of forest trees [*R.A.M.*, xxi, p. 298], the author states that her experiments demonstrated conclusively that increased supply of nutrients played a relatively insignificant part in the improved fertility of the Wareham soil induced by the addition of composts. They confirmed the presence of soil substances deleterious to growth, and showed that it was obviated by the addition of compost, though the addition of the equivalent amount of salts had no effect.

The author considers that the striking effects on tree growth brought about by composts on natural soils do not depend to any extent upon the addition of nutrients, but are directly associated with qualitative changes in the humus constituents and with the biological activities related with these. They may also, possibly, be associated with the presence of growth-promoting substances in individual composts or produced in the soil as the result of fungal activation.

Hooker (W. J.), Walker (J. C.), & Smith (F. G.). **Toxicity of beta-phenethyl isothiocyanate to certain fungi.**—*Amer. J. Bot.*, xxx, 8, pp. 632–637, 2 graphs, 1943.

In this account of studies on the toxicity of beta-phenethyl isothiocyanate in comparison with allyl isothiocyanate [*R.A.M.*, xix, p. 298] in solution culture to *Aspergillus alliaceus*, *Colletotrichum circinans*, *A. niger*, and *Gibberella saubinetii* [*G. zeae*], and of the toxicity of the former as a vapour to the same fungi, the authors point out that the evaluation of beta-phenethyl isothiocyanate as a toxic agent affecting fungi is important because it is a normal constituent of the roots of certain members of the Cruciferae. Hence it possesses a more immediate importance than allyl isothiocyanate as a possible agent in preventing or impeding invasion by root pathogens.

It was found that of the fungi tested, *A. alliaceus* was least sensitive to both oils, followed in order of increasing sensitivity by *C. circinans*, *A. niger*, and *G. zeae*. There was little difference in the relative toxicity of the two oils in the liquid phase to *C. circinans* and *A. niger*, though the allyl oil was slightly the more toxic of the two to *G. zeae* and much the more so to *A. alliaceus*. The response of the fungi to the vapours of beta-phenethyl isothiocyanate was found to depend upon their degree of tolerance to the oil, only *A. niger* and *G. zeae* being inhibited by partial pressures of oil in equilibrium with aqueous solutions in adequate volume. In the vapour form the allyl oil was many times as toxic as the phenethyl, these differences being, apparently, correlated with differences in the vapour pressure of the two oils.

Cockerham (G.). **The reactions of Potato varieties to viruses X, A, B, and C.**—*Ann. appl. Biol.*, xxx, 4, pp. 338–344, 1 pl., 1943.

In this account of the reactions of 146 potato varieties to graft infection with viruses X, A, B [a strain of X], and C [strain of Y] on a basis of their top-necrotic or non-necrotic symptoms, the author states that a cardinal distinction between potato varieties in their response to these viruses is that some are killed with top necrosis while others produce non-necrotic symptoms. Top necrosis may be

regarded as the index of field immunity from the causal virus, but in the work under review it was taken to indicate that infection of the variety examined had been accomplished. Acceptance of the virus without the production of top necrosis was confirmed in every instance by its recovery on a suitable indicator host; the potato varieties Epicure for virus X, Great Scot for A, Arran Victory for B, and Majestic for C were found most suitable for this purpose. The U.S. seedling 41956 failed to accept viruses X and B in some of the trials, its immunity from them being thus confirmed.

With regard to virus X, it is pointed out that as over 70 per cent. of the total potato acreage in Great Britain is planted with varieties susceptible to X, the total annual loss from the virus is considerable, many varieties being completely permeated with the virus, while most show considerable infection. Susceptible varieties need not preponderate in the agricultural practice of the future, as field immunity from X is inherited as a Mendelian dominant, and no insurmountable difficulties prevent the development of field-immune varieties. The essential genes are available within the range of varieties now cultivated, and only selective reassortment is necessary for their employment to the greatest advantage.

Top necrosis due to virus A differs from that due to virus B in its initial symptoms only. Virus A is widely distributed, and may by itself reduce yields. With X, it is jointly responsible for crinkle. It is aphid-transmissible, but not easily transferred by sap-inoculation. Its economic significance is mainly restricted to areas where aphids are abundant, and where, as a result, leaf roll and virus Y are of greater significance. In Great Britain, over 56 per cent. of the potato acreage is planted to varieties field-immune from A. Apparently, it is of relatively small importance as a factor in disease causation in all but a few commercial varieties, such as Golden Wonder, Catriona, and Immune Ashleaf. In these cases, the problem of disease control arises mainly from the infiltration of virus X into the stocks and not from the spread of A from them.

All the evidence supported the view that virus B is a strain of X. The distribution of B in Great Britain is closely associated with that of X, both being recorded from most varieties susceptible to both. There is no record of B from varieties field-immune from X. The distribution of B is less extensive than that of X, but it is found quite commonly in varieties susceptible to both viruses, which compose 55 per cent. of the potato acreage.

Infection by virus C through sap inoculation with carborundum as an abrasive was accomplished on several occasions. The varieties Epicure, Majestic, British Queen, Up-to-Date, Craigs Defiance, and President, which all show top necrosis when graft-infected, responded to sap inoculation with the formation of local necrotic lesions on the inoculated leaves. With the exception of a single plant of Craigs Defiance, which succumbed with top necrosis, no systemic invasion occurred. Arran Victory, when similarly infected, accepted the virus with the production of a chlorotic crinkle similar to that induced by virus Y on this variety. The similarity of the effect of C and Y on various hosts suggests that either Y is a constant contaminant of C, or that C is so closely allied to Y that it evokes similar host reactions. The evidence, on the whole, supports the second alternative. While the disease induced by C is frequently severe, it appears to be rare.

An appendix is given in which the varieties tested are listed alphabetically, and their reaction to each of the four viruses is shown. Those found field-immune from all four are Benalt, Craigs Defiance, Crusader, Harbinger, and Thorn II.

BALD (J. G.). **Potato virus X: mixtures of strains and the leaf area and yield of infected Potatoes.**—*Bull. Coun. sci. industr. Res. Aust.* 165, 32 pp., 1943. [Photo-lithographed.]

Tests conducted at Canberra over a five-year period to determine the relation

between the yield of Up-to-Date potatoes and the strain mixtures of potato virus X harboured by them afforded proof of an inverse ratio between severity and production. The symptoms induced on potato plants in the greenhouse by inoculation with mixtures containing various proportions of severe and necrotic strains of virus X resembled those resulting from comparable spontaneous infections. The results of inoculations with strain mixtures on *Datura stramonium* suggest that the symptoms caused by virus X on potatoes are mainly due to mixtures containing the necrotic strains in concentrations of less than 50 per cent. A number of the manifestations of infection on *D. stramonium* were tested as indexes of severity, and those based either on the symptom rating or the incubation period or both, are proposed as criteria of virulence.

A small-scale trial with Up-to-Date in 1940–1 demonstrated an inverse ratio between the severity of X mixtures carried by tuber lines and the yields. In the early stages of growth there was no relation between vigour of the haulms and virulence of the mixtures. The results of another test in the same year on 25 tuber lines showed that mixtures of differing severity exerted no effect on the leaf area or growth rate until flowering, while the only indication of an influence of virulence on maturity was that a larger number of plants carrying severe mixtures died off prematurely. In further experiments in 1941–2 differences in yield between tuber lines were found to be highly significant: it was calculated from the regression of yield on severity that a masked strain of X reduced the harvest by about 12 per cent. and the most severe naturally occurring strain mixture by 45 per cent. A test on two lots of Great Scot, one infected with a masked strain of X and the other virus-free revealed no effect of the disease on leaf area at maturity, but again there was a significant reduction of 12 per cent. in yield.

SMITH (K. M.). **Studies on the spread of certain plant viruses in the field.**—*Ann. appl. Biol.*, xxx, 4, pp. 345–348, 2 figs., 1943.

In studies on the spread of potato viruses X and Y and cucumber mosaic virus in the field, White Burley tobacco plants were set out in two series of plots, each in the shape of a cross. In the case of potato virus X, the plants in one plot were placed 4 ft. apart and were not in contact, though in the other plot they were only 1 ft. apart, and were in contact. In each of these plots, four X-infected tobacco plants at the centre served as a virus source. A duplicate series was set out to study the spread of virus Y, while a third series with no virus source served as control. No plot was set aside for cucumber mosaic, as it was known that this always appeared.

No spread of virus X was observed in the field, though a glasshouse test demonstrated that it can be passed from diseased to healthy tobacco plants by mechanical contact.

Spread of virus Y, on the other hand, was rapid and complete, but there was no evidence of spread by mechanical contact, as healthy plants were commonly found between two diseased ones. On 20th July, two Y-infected plants were found in the 'spaced' control plot, as compared with 17 in the spaced plot with the virus sources at the centre; on the same date, the contact control plot had 7, and the contact experimental plot 63, infections. It therefore seems clear that close proximity of a source of virus infection was an important factor in spread. By 18th August, the spaced control plot had 32 diseased plants out of 64, and the contact control plot 62 out of 160, compared with nearly 100 per cent. infection in the experimental plots.

Cucumber mosaic reached the plots considerably after the appearance of potato virus Y, presumably because it had to come a greater distance, there being no known source of infection in the immediate vicinity. Once it was present, its

subsequent spread was much slower than that of Y. Transmission by mechanical contact did not appear to take place.

CZERWINSKI (H.). **Untersuchungen und Beobachtungen über die Blattlaus Myzodes persicae Sulz. als Verbreiter des Kartoffelabbaues auf dem Versuchsfeld des Instituts für Acker- und Pflanzenbau Berlin-Dahlem und dem Versuchsgut Thyrow.** [Investigations and observations on the aphid *Myzodes persicae* Sulz. as a vector of Potato degeneration on the experimental field of the Institute for Agriculture and Plant Organization Berlin-Dahlem and the Thyrow experimental farm.]—*Angew. Bot.*, xxv, 3–4, pp. 201–250, 8 figs., 1943.

An exhaustive, fully tabulated survey is given of investigations carried out from 1938 to 1940, inclusive, to determine the possibility of an etiological connexion between the prevalence of *Myzodes* [*Myzus*] *persicae* and the very variable incidence of potato degeneration on the experimental sites at Berlin-Dahlem (administrative district of Teltow, 40 km. south-west of Berlin) and Thyrow, which was consistently higher in the former than in the latter locality. This discrepancy, which was particularly marked in the first two years of the inquiry, is attributed to the fact that the numbers of peach trees (in which the insects overwinter) per ha. of land under potatoes in Dahlem and Thyrow are 152 and 7, respectively [*R.A.M.*, xxii, p. 268]. With a stationary relative peach population in the experimental areas, the other decisive factor in the infestation of the potato crops is the prevailing mean temperature and humidity during the peak period of aphid development (April to June), the warmer and drier the weather the more intensive being the activity of the insects. Climatic factors tending to reduce aphid reproduction include extremes of temperature, persistent rain, and sudden very heavy showers.

During the exceptionally severe winter of 1939 to 1940, most of the peach trees in the experimental areas died, and *M. persicae* was largely superseded by the sluggish and therefore relatively unimportant *Doralis* [*Aphis*] *rhamni* which seldom migrates from the initially colonized leaves [cf. ibid., xxii, p. 446].

Wingless aphids were observed to be actively motile within a restricted area. Thus, on one day of fine, dry weather, 15 per cent. left the plant on which they originated; of these 53 per cent. had only travelled as far as the immediately contiguous plants on either side. A total of 62 per cent. of the migrating aphids remained in the row containing the plant of origin, 35 per cent. reached the next rows on either side, while only 2 per cent. were counted on the next ones further away. The movement of the insects was promoted by showers and strong winds: it was effected for the most part by crawling from leaf to leaf of neighbouring plants, and to a lesser extent by way of the ground.

Observations on caged plants emphasized the particular virulence of early aphid infestations, which may involve the loss of the entire current season's crop. The yield of plants remaining free from attack until flowering is not reduced, but their progeny may be altogether diseased under unfavourable environmental conditions.

PAL (B. P.). **Virus diseases of Potatoes in India.**—*Curr. Sci.*, xii, 10, p. 279, 1943.

In the opinion of Dr. R. N. Salaman, of the Potato Virus Research Station, Cambridge, tubers of the important commercial Phulwa (Patna White) potato variety submitted to him for inspection in 1938 were affected by potato virus Y. The use of healthy tubers and thorough roguing have been largely successful in the control of the disease at New Delhi. In one test, for instance, the percentages of infected plants arising from (*a*) tubers from apparently sound plants after roguing, (*b*) tubers from a field where roguing was not practised, and (*c*) tubers from diseased plants, 40 days after planting, were 5·2, 9·8, and 16·1, respectively, the corresponding figures for two further counts at monthly intervals being 7·5, 16·8, and 24·9,

and 9·4, 19·8, and 28·2, respectively. In an experiment to determine the effect of dates of planting on the incidence of virus Y, the percentages of diseased plants for plantings of 15th September, 1st and 15th October, and 1st November were 31·3, 35·6, 4·9, and 7·3, respectively. Not all the tubers from an affected plant produced diseased offspring. When single-plant progenies were grown separately, usually only 50 to 60 per cent. of the resulting stand contracted the disease. Darjeeling, Red Round, and other commercial Indian varieties also suffer from virus Y.

The only other virus disease that has been definitely identified on potatoes in India is leaf roll.

BLACK (W.). **Inheritance of resistance to two strains of blight (Phytophthora infestans de Bary) in Potatoes.**—*Trans. roy. Soc. Edinb.*, lxi, 1, pp. 137–147, 1943.

Two strains of potato late blight (*Phytophthora infestans*) were used in the writer's studies on the inheritance of resistance to the disease at the Scottish Plant Breeding Station, Corstorphine, Edinburgh [*R.A.M.*, xxii, p. 447], viz., the common A and a more virulent physiologic form B arising from the former [ibid., xii, p. 390 *et passim*]. Segregations of resistant and susceptible plants following infection by the two strains have been traced through several generations of hybrids bred from (*a*) *Solanum rybinii* (susceptible), *S. demissum* (resistant), and a number of cultivated varieties of *S. tuberosum* (susceptible), and (*b*) *S. demissum* and *S. tuberosum*, and the data thus obtained suggest that the inheritance of resistance to these physiologic forms is governed by two factors of different phytogenetic origin, designated Ra and Rb, the former conferring resistance to A only and the latter to both A and B. These results are in agreement with published cytological evidence indicating that the species of potato concerned are of hybrid origin, with 6 as the most probable basic chromosome number. The inheritance of resistance to late blight is accordingly explicable on the basis of the allopolyploid character of the species, *S. rybinii* being treated as an allotetraploid, *S. tuberosum* as an allo-octoploid, and *S. demissum* as an allododecaploid.

STARR (G. H.), CYKLER (J. F.), & DUNNEWALDE (T. J.). **The effect of moisture and other factors on Potato scab.**—*Amer. Potato J.*, xx, 11, pp. 279–287, 1 fig., 1943.

In a field experiment carried out in Wyoming in 1942 to ascertain the effect of irrigation practices on the incidence of potato scab (*Actinomyces scabies*), four plots were used, (1) 'general practice', five irrigations at intervals of 6 to 20 days, or a total of 45 in. of net irrigation water, (2) 'minimum soil moisture variation', nine irrigations at intervals of 3 to 8 days, or a total of 60·7 in. of net irrigation water, (3) 'medium soil moisture variation', eight irrigations at intervals of 4 to 12 days, or a total of 47 in. of irrigation water, and (4) 'wide soil moisture variation', four irrigations at intervals of 12 to 18 days, or a total of 11·5 in. of net irrigation water. The 'index numbers' for scab incidence in the four plots, were, respectively, 202, 235, 224, and 203. Thus, most scab developed in those plots that received the most irrigation water.

No significant relation was established between scab incidence and soluble salts, P_H value of soil, lime content, available phosphorus, or potassium.

The yield of the 'wide variation' plot was significantly less than those of the 'general practice' and 'minimum soil moisture variation' plots.

STARR (G. H.). **Ring rot increase in Potato seed lots having known quantities of infection.**—*Amer. Potato J.*, xx, 9, pp. 237–241, 1943.

One-bushel samples of potatoes, each containing a trace of ring rot [*Coryne-*

bacterium sepedonicum], were sent from Maine, Minnesota, Nebraska, New York, and North Dakota to the Wyoming Agricultural Experiment Station, where the extent of increase of infection was determined in the 1942 crops, both by external symptoms and the Gram-stain method [*R.A.M.*, xxi, p. 390].

The number of plants showing symptoms of ring rot in the five lots derived from whole tubers were 0 out of 27 hills, 1 (5 questionable) out of 123, 0 out of 52, 0 out of 22, and 0 (1) out of 72, respectively, the corresponding figures for cut tubers being 0 (3) out of 380, 1 (8) out of 354, 2 (0) out of 467, 1 (5) out of 298, and 1 (12) out of 386, whilst the percentage of ring rot detected by the stain technique were 0, 4·88, 0, 0, and 1·39, and 0·79, 1·41, 1·50, 0·67, and 1·55, respectively. The samples with a trace of disease produced an average of 1·31 per cent. infection in the subsequent crop.

Furthermore, percentages of ring rot ranging from 0·1 to 1 were introduced by means of infected tubers at well-spaced intervals during cutting in five lots of healthy Bliss Triumph seed; one half of each tuber was immersed for 20 minutes in 1 in 500 mercuric chloride and the other half left untreated. The amounts of infection developing in the disinfected and control lots ranged from 0·6 to 2·6 and 1·5 to 18·7 per cent., respectively.

Botanical and Mycological Department.—*Rep. Rubb. Res. Bd, Ceylon, 1942*, pp. 6–11, 1943.

In this report [cf. *R.A.M.*, xxii, p. 274] it is stated that during 1942 weather conditions in Ceylon were unfavourable for the development of *Oidium* leaf disease of rubber [*O. heveae*], but wet weather from June onwards caused a heavy outbreak of secondary leaf fall and pod rot due to *Phytophthora palmivora*. Striking differences were observed in the resistance shown by various clones to the latter fungus.

A small-scale experiment made to investigate various methods of treating stumped buddings before and immediately after transplanting for the avoidance of sun scorch [ibid., xxi, p. 97] and die-back demonstrated conclusively that with good nursery material and careful transplanting stumped buddings can be successfully established in the north-east monsoon planting season.

Teakle (L. J. H.) & Turton (A. G.). **The copper, manganese, and zinc content of the Subterranean Clover and Oats in Western Australia.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xx, 3, pp. 238–259, 1 map, 1943.

A survey of the copper, manganese, and zinc content of subterranean clover [*Trifolium subterraneum*], oats, wheat, and barley, representing soils from a considerable portion of the agricultural parts of Western Australia, showed that copper deficiency [*R.A.M.*, xxii, pp. 37, 246] is general in certain areas. The localities most severely affected are Gingin, Dandaragan, South Busselton, and the south coastal districts. The better-class soils, including loams and clay loams, are usually well supplied with copper, the sandy loams are mostly fairly rich in the metal, but certain classes of the sandy and gravelly types are low in available copper. Manganese deficiency is not general. Zinc deficiency may be present in some light soil types. Lack of these elements may be rectified by their incorporation in the fertilizer mixture.

D[odds] (H. H.). **Sugarcane diseases and insect pests in South Africa. A review of the position. Experiment Station notes.**—*S. Afr. Sug. J.*, xxvii, 8, p. 340; 9, p. 405, 1943.

The virus diseases, streak and mosaic, formerly a source of heavy loss in the South African sugar-cane industry, are stated to have almost entirely disappeared from commercial plantings owing to the establishment of resistant varieties, but

their role as pathogens has to some extent been assumed by fungous diseases, especially red rot [*Colletotrichum falcatum*: *R.A.M.*, xxii, p. 453]. So far, widespread damage has been confined to the Co. 290 and P.O.J. 2725 varieties within the 'mist belt', but recent advice from India that Co. 331 is also susceptible drew attention to some cases of infection on the last-named variety at the Mount Edgecombe Experiment Station, Natal. In September, 1943, *C. falcatum* was further observed for the first time on Co. 464, one of the most promising of the newer Indian varieties, while Co. 453, already attacked in 1942, was again infected, as also were a locally raised seedling, N.Co. 318, two lines derived from Mauritian seed, and the unreleased variety M.P.R. 151 (at Umfolozi).

Eye spot [*Helminthosporium sacchari*], ordinarily of negligible importance, may temporarily assume a destructive form and be hardly recognizable as the same disease. This change in the character of the disease has been twice recorded in South Africa, once on the unreleased variety Co. 419 at the Experiment Station, and once on Co. 290 at Nkwalini.

Seedlings of Hawaiian origin appear to be particularly susceptible to *Fusarium moniliforme* [*Gibberella fujikuroi*: loc. cit.].

Some leaves submitted for examination from Tucumán, Argentina, where streak was suspected, were found to be affected by 'stipple', a common non-infectious type of spotting.

MUNGOMERY (R. W.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas Qd, 1942–43*, pp. 18–19, 1943.

In this report on sugar-cane disease work in Queensland during the season 1942–3 [cf. *R.A.M.*, xxii, p. 276] it is stated that gumming disease [*Xanthomonas vasculorum*: loc. cit.] was of little consequence, having disappeared from the southern and central districts, where a few years ago it seriously threatened the sugar industry, and considerably subsided in the north. Following the elimination of fields of susceptible varieties in the Mulgrave area, the only sources of danger are the odd stools of these varieties still present in other plantings. In resistance trials conducted at Brisbane the following varieties showed neither oozing of gum nor dead stalks: Akbar, Atlas, China (Cow cane), C.S.R. 1 (Cow cane), D. 166/34, E.G. 1 (Cow cane), Q. 30, Q. 35, Q. 41, Q. 42, and Q. 813.

Downy mildew [*Sclerospora sacchari*: ibid., xxi, p. 503] was well under control in the Mossman, Hambledon, Mulgrave, and Mackay areas, and there was a further improvement in the Bundaberg area, the number of diseased stools of cane in 1943 averaging 0·055 per acre as compared with 0·074 in 1942.

Fiji disease [loc. cit.] is reported to have increased in the Bundaberg district. Of the 275 farms recorded as diseased in this area since inspection started, 71 are now free from disease, while in the remaining 204 an average of 28 stools per farm was rogued during the season under review. In the Maryborough area, only 390 stools were found in the 5,409 acres inspected and this improvement has permitted the reintroduction of P.O.J. 2878 and M. 1900S. In the Isis area the disease was more prevalent owing largely to the regrettable, but sometimes unavoidable, practice of leaving diseased blocks to stand over. Negligible losses were caused in the Moreton area. The results of resistance trials completed during the year showed Q. 28, Katha, Saretha, *S[accharum] spontaneum* Tank., and *S. spontaneum* Burma to be highly resistant, while Co. 364 exhibited only a small amount of infection; the Hawaiian canes, 28–4291, 31–2484, 31–2806, and 32–8560, appeared to be highly susceptible; and the standards, D. 1135 and P.O.J. 2878, showed 81 and 71 per cent. infection, respectively.

The usual small amount of leaf scald [*X. albilineans*: ibid., xxi, p. 304] is reported from the far northern districts; in the Mulgrave area the disease was fairly prevalent in Oramboo.

The position with regard to chlorotic streak [loc. cit.] is stated to be unchanged.

Sclerotial leaf disease, usually of very minor importance, caused some deaths in Badila, and in P.O.J. 2878 in the Herbert River district.

Mosaic disease [loc. cit.] attracted some attention during the year by affecting some of the new varieties, namely Q. 25 and Q. 28, and several of the standard canes.

Cross (W. E.). **Declaración referente al 'carbón' de la Caña de Azúcar.** [A statement in reference to Sugar-Cane 'smut'.]—*Circ. Estac. exp. agríc. Tucumán* 120, 4 pp., 1943.

This is a summary of the information set forth in previous publications of the Tucumán (Argentina) Agricultural Experiment Station concerning sugar-cane smut (*Ustilago scitaminea*) [see above, p. 120]. During the last two or three years, especially in 1943, local growers have made extensive use of semi-resistant to practically immune varieties, which it is estimated now occupy roughly half the acreage under sugar-cane, the remainder being planted with the susceptible P.O.J. 36. Assuming that the latter produces a moderate yield, the prospects for the 1944 harvest are reasonably favourable in the absence of exceptionally adverse climatic conditions.

Dade (H. A.). **Colour terminology in biology.**—*Mycol. Pap. Imp. Mycol. Inst.* 6, 21 pp., 4 charts, 1943. 3s. 9d.

While a standard system such as Ridgway's, comprising over 1,100 colours, enables the colours of organisms to be accurately recorded, the common, suggestive Latin names in regular use by biologists are often indefinite, ambiguous, and misapplied. The author therefore proposes the selection and definition of appropriate terms, covering the entire range of Ridgway's classification and maintaining, as far as possible, the classical names of Saccardo's 'Chromotaxia'. To this end the Latin and English names of colours are listed, with necessary amplifications and critical annotations, the range of each name being further shown diagrammatically.

Waksman (S. A.) & Henrici (A. T.). **The nomenclature and classification of the Actinomycetes.**—*J. Bact.*, xlvi, 4, pp. 337–341, 1943.

Waksman's system of classification of the Actinomycetes [*R.A.M.*, xix, p. 617] has been criticized in regard to the designation and position of the anaerobic pathogenic species responsible for human actinomycosis and bovine 'lumpy jaw', which were referred to the genus *Cohnistreptothrix* Pinoy, *Actinomyces* being reserved for the aerobic spore-forming species. The authors have therefore sought to meet at once the objections of critics and the requirements of the Microbiological and Botanical Codes by the following scheme. The restriction of *Actinomyces* to the anaerobic pathogens necessitates the reference of the aerobic non-sporulating Actinomycetes, which multiply by fragmentation of the hyphae into oidia, to *Nocardia* Trevisan 1888, this genus having priority over *Proactinomyces* Jensen 1931 [ibid., xi, p. 602]. Turning to the aerobic species forming apparently endogenous spores in chains on aerial hyphae and not fragmenting into oidia, no valid generic name could be found in the relevant literature for this large group of soil organisms, and *Streptomyces* is therefore proposed as indicating the essential character of the class, with the new combination *S. albus* (Rossi-Doria emend. Krainsky) comb. nov. *Micromonospora* Ørskov is apparently still valid for the accommodation of forms producing single conidia on lateral branches. These two genera constitute the new family Streptomycetaceae.

Bisby (G. R.). **Stachybotrys.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 133–143, 9 figs., 1943.

A brief historical sketch of the genus *Stachybotrys* and its species is given, with descriptions and figures of specimens and cultures. The genus is considered to have two good species. The name *S. atra* Corda may be used for the one common in northern temperate regions, while a second species in warmer areas is interpreted as *S. subsimplex*. Both species are saprophytic, but *S. atra* may cause commercial damage to paper or cloth.

Karling (J. S.). **The life history of Anisolpidium ectocarpii gen. nov. et sp. nov., and a synopsis and classification of other fungi with anteriorly uniflagellate zoospores.**—*Amer. J. Bot.*, xxx, 8, pp. 637–648, 21 figs., 1943.

A new genus *Anisolpidium* is established for fungi with anteriorly uniflagellate spores, the name *A. ectocarpii* being proposed for the type species. All 14 fungi with zoospores of this nature are removed from the Chytridiales and placed in a separate order, the Anisochytridiales, which contains three families (Anisolpidiaceae, Rhizidiomycetaceae, and Hyphochytriaceae), seven genera, and about 14 species, including *Rhizidiomyces apophysatus* Zopf, parasitic on *Saprolegnia ferax* and other species, and *Hyphochytrium catenoides*, weakly parasitic on maize.

Padwick (G. W.) & Merh (J. L.). **Notes on Indian fungi. I.**—*Mycol. Pap. Imp. Mycol. Inst.* 7, 7 pp., 6 figs., 1943.

This series gives information on miscellaneous fungi noted at the Imperial Agricultural Research Institute, New Delhi, and which it is not immediately convenient to include in the groups undergoing critical taxonomic investigations. The present annotated list comprises 13 species collected between 1939 and 1941. *Sphaerotheca lanestris*, originally described by Harkness in *Bull. Calif. Acad. Sci.*, i, p. 40, 1886, on *Quercus agrifolia* and since observed on other species of oaks in America and Japan, was found, for the first time in India, on *Q. incana* (a new host) at Mussoorie, United Provinces. The dense, brownish-white mycelial felt covering the young leaves causes thickening, brittleness, and stunting. The perithecia developing profusely on the lower surfaces of older leaves are spherical to ovoid, dark brown to black, 77 to 98 (average 81) μ in diameter, and furnished with short appendages; the asci are ovoid, apedicellate or at most provided with a basal papilla, 70 to 130 by 46 to 74 (109 by 63) μ, and contain eight spores measuring 13·9 to 20·2 by 12·1 to 18·6 (21 by 15·5) μ.

Coniothyrium arecae n. sp. forms on areca palm leaves in Assam pale green, later brown, elliptical, coalescent lesions, ultimately involving the major part of the surface. The amphigenous pycnidia measure 126 to 188 μ in diameter and the dark spores 4·8 to 7·1 by 2·6 to 4·3 μ.

Hyoscyamus niger in Kashmir is attacked by *Ascochyta kashmiriana*, which produces on both leaf surfaces orbicular, zonate, vinaceous-buff to wood-brown, coalescent spots, up to 10 mm. in diameter. The pycnidia developing sparsely on the upper leaf surface are globose, brown, and measure 85 to 171 (118) μ in diameter, and the spores are subhyaline, cylindrical, uni- or rarely biseptate, 15·3 to 24·9 by 2·1 to 5 (19·2 by 3·8) μ.

Septoria gypsophilae var. *macrospora* n. var. on *Gypsophila cerastioides* at Katarnag, Kashmir, differs from the type species only in its longer spores (23·5 to 32 by 2·5 to 3·2, average 27·6 by 2·8 μ, as against 15 to 25 by 2·5 μ).

Mention may also be made of *Wallrothiella bromeliae* on pineapple leaves (a new record for India) at Dangri, Assam, *Epichloe typhina* on *Brachypodium sylvaticum* (a new host record for India) at Simla, *Septoria apii-graveolentis* on wild celery [*R.A.M.*, xii, p. 196] at Gunderbal, Kashmir, and *Venturia inaequalis* on *Pyrus lanata* (a new host for the pathogen) in Kashmir.

Price (W. C.) & Spencer (E. L.). **Accuracy of the local-lesion method for measuring virus activity, III. The standard deviation of the log-ratio of potencies as a measure of the accuracy of measurement.**—*Amer. J. Bot.*, xxx, 9, pp. 720–735, 1943.

Statistical analyses are given of the data obtained in the authors' experiments on the measurement of the activity of tobacco mosaic, tobacco necrosis, lucerne mosaic, and tobacco ring spot viruses by the numbers of local lesions produced on half leaves of Early Golden Cluster bean plants [*R.A.M.*, xxii, p. 499]. The method of measuring activity involved the comparison of dilutions of a standard virus preparation with an equal number prepared from the test virus and the standard deviation of the estimate was calculated from a complicated equation [which is given]. The results showed that the standard deviations of the estimates generally agreed well with the true errors of the estimates except in the case of lucerne mosaic. For some reason as yet not determined the method was found to be biased for this virus. The results obtained with tobacco mosaic, tobacco necrosis, and tobacco ring spot suggest that the standard deviation gives a reliable measure of the experimental error.

Gerstel (D. U.). **Inheritance in Nicotiana tabacum. XVII. Cytogenetical analysis of glutinosa-type resistance to mosaic disease.**—*Genetics*, xxviii, 6, pp. 533–536, 1943.

In the mosaic-resistant tobacco variety, Holmes Samsoun, a pair of *Nicotiana glutinosa* chromosomes has been substituted for a pair of *N. tabacum*. In hybrids of Holmes Samsoun with Purpurea the *glutinosa* chromosome fails to conjugate with its *tabacum* analogue. The transmission of mosaic resistance parallels distribution of the non-conjunctional pair of chromosomes, demonstrating that one of those carries the factor or factor complex for resistance. In heterozygous plants, in consequence of non-conjunction, some 20 per cent. of female gametes contain the *tabacum*, and a comparable number the *glutinosa* chromosome, the remaining 60 per cent. consisting mainly of 23-chromosome gametes and a few with 25, all being functional. On the male side unbalanced 23- and 25-chromosome gametes very rarely function, so that a 1 : 1 transmission ratio is secured by back-crossing heterozygous plants, which should be used by plant-breeders as pollen parents in the transference of mosaic resistance to other *N. tabacum* varieties.

Dimofte (N.). **Die chemische Zusammensetzung von mosaikkrankem Tabak.** [The chemical composition of mosaic-diseased Tobacco.]—*Bul. Cult. Tutun.*, xxxi, pp. 273–278, 1942. [Rumanian. Abs. in *Chem. Zbl.*, cxiv (ii), 12, p. 1155, 1943.]

In experiments with Virginia tobacco, infection by the mosaic virus was found to increase the total nitrogen and protein contents and to lower those of nicotine, reducing substances, carbohydrates and polyphenol compounds, the Schmuck coefficient, and the benzol- and ether-soluble resins.

Mira (E. A.). **Tobacco varieties resistant to ordinary mosaic.**—*Int. Bull. Pl. Prot.*, xvii, 2, pp. 17M–18M, 1943.

In breeding work carried out since 1933 at the Station for Tobacco Studies, Santiponce, Seville, to obtain tobacco varieties resistant to ordinary mosaic, the Colombian variety Ambalema [*R.A.M.*, xxii, p. 499], known in Spain as Colombia, which is resistant to types of ordinary mosaic and closely related viruses, was crossed with a number of varieties ordinarily grown in Spain, including Valencia Alto, Valencia Bajo, Filipino, Maryland, and Habano. In 1940, a fourth generation was obtained, and it was found that there was no correlation between the development and vigour of the plants and their disease resistance. Only a few plants were

resistant, and these were not the best. The seeds of these were harvested separately. To ascertain whether resistance in these plants was transmitted uniformly to all the progeny, an auxiliary generation was raised under glass, and it was found that of the 28 progeny studied, 17 were uniformly resistant. No seed was kept from this test. A fifth generation was next raised in the open; of the new varieties found to be resistant the following are the most important: hybrid 57A (Colombia × Valencia Alto), hybrid 57B (Colombia × Valencia Alto), and hybrid 60 (Colombia × Filipino). The last-named is considered to be particularly promising, being not only resistant, but giving tobacco of high quality. Further work is in progress.

McKinney (H. H.) & Clayton (E. E.). **Acute and chronic symptoms in Tobacco mosaics.**—*Phytopathology*, xxxiii, 11, pp. 1045–1054, 2 figs., 1 diag., 1 graph, 1943.

The studies herein described were concerned chiefly with the succession of symptoms developing in the natural course of a yellow mosaic in tobacco, while some attention was also paid to a similar progression of common mosaic. The hosts used were Samsun (Turkish) tobacco and an F_1 generation of the back-cross *Nicotiana tabacum* × *N. longiflora* × *N. tabacum*, and the viruses used were wild-type common mosaic (*Nicotiana* virus 1) [tobacco mosaic virus], yellow mosaic mutant virus BSY [*R.A.M.*, xxii, p. 500], and a yellow (white) mosaic virus obtained from W. D. Valleau [loc. cit.].

Two major phases, an acute and a chronic, were differentiated, the former characterized by severe chlorosis and/or early death of the diseased tissue, the latter by symptoms which may or may not be obvious, death of the tissues following chlorosis only after a long delay or under more extreme environmental conditions than those required for acute reactions. The contrast between the two phases was much more noticeable in yellow than in ordinary tobacco mosaic, in which the virus proceeds comparatively slowly. This differential rate of movement influences the number of leaves in the acute phase and the time of onset of the typical chronic symptoms. A common acute reaction to midsummer infection by the tobacco mosaic virus is necrosis of the older foliage, designated 'blister' by McMurtrey [ibid., viii, p. 533] and 'burning' by Valleau and Johnson (*Bull. Ky agric. Exp. Sta.* 361, pp. 233–238, 1935). The acute phase of yellow mosaic is divided into five types, lettered A to E, inclusive, which intergrade all expressions tending to form a sequence that seems to parallel the natural growth phases of the developing leaves rather than virus movement with respect to vascular channels in relation to phyllotaxy. The chronic phase is represented by two types, F and G. All the types are described in detail.

It seems evident, from these graduated reactions to the tobacco mosaic virus of leaf tissues of different ages, that natural resistance changes with their growth and development, the type of response being presumably determined by the level of resistance at the moment of infection. The observed resistance of young tissues may be due either to inability to maintain a high level of virus synthesis, or to the presence of some condition tending to retard the movement of the infective principle. In addition to very young material, the tissues of adult foliage show more resistance than those of the intermediate stages of growth.

Western (J. H.) & Stewart (R.). **The effect of a chemical soil sterilizing agent on the subsequent development of Tomato plants.**—*Ann. appl. Biol.*, xxx, 4, pp. 370–372, 1 pl., 1943.

Malformed tomato plants having been received from several growers who had all used the same proprietary soil-sterilizing agent, the essential ingredients of which were ortho-dichlorbenzene and an emulsifying agent of the sulphonated oil type, an experiment was carried out in which Ailsa Craig tomato seeds were

grown in compost (*a*) untreated, (*b*) treated with formalin (2 per cent. solution in water), (*c*) the proprietary material (0·5 per cent. solution), cresylic acid (2·5 per cent. solution), and carbon bisulphide (1·33 per cent.).

Germination, except in the cresylic acid series, was good, the ortho-dichlorbenzene giving a rapid and even germination of 96·5 per cent. In this treatment, no sign of abnormality occurred until seven weeks after planting, when every plant showed distortion of the fifth and sixth leaves. The laminae were reduced and misshapen, often consisting of only a thin band of assimilating tissue bordering the veins. All the leaves above the fifth and sixth were abnormal, and the main stem failed to develop at the normal rate, the plants becoming stunted. Subsequently the new growth was progressively more normal, until, in the uppermost portions of mature plants, complete normality appeared to have been attained in leaf, flower, and fruit. The weight of fruit from abnormal plants, however, was appreciably less than that from the controls, averaging (6 plants) only 5·29 lb. per plant, as against 8·14 lb.

A further experiment demonstrated that the ingredient responsible for the injury was the ortho-dichlorbenzene.

Roberts (F. M.). **Factors influencing infection of the Tomato by Verticillium albo-atrum.**—*Ann. appl. Biol.*, xxx, 4, pp. 327–331, 1943.

In studies on the factors influencing the infection of tomatoes by *Verticillium albo-atrum* [*R.A.M.*, xxii, p. 466], Kondine Red seedlings were raised to about the eight-leaf stage in pots. The experimental containers were wooden flats, which were half-filled with different soils. A layer of a culture of the fungus was spread over the surface of the soil, and the flat was then filled up with the same soil. On the surface of the soil in each flat, six small pots were placed, each containing a healthy plant with roots appearing at the drainage hole. Between spring and late autumn, disease development could frequently be estimated by external symptoms. Wilting, however, was often only transitory. Yellowing of the lower leaves was not a reliable symptom in experiments involving soil deficient in one or more nutrients. In some tests, particularly in those carried out late in the year, some infected plants showed no external symptoms. In these experiments, brown staining of the wood was a moderately reliable indication of infection. In some plants, a reliable symptom of severe infection was an orange-brown external discoloration of some of the roots.

In the first experiment, four different quantities of maize meal-sand inoculum, together with a spore-suspension inoculum, were compared in an organic allotment loam and in this diluted with three times its volume of sand. In the undiluted soil there were in all 20 infections (five in roots only) and in the diluted only 8 (5 in roots only).

In another experiment it was found that soil inoculated immediately after steam sterilization particularly favours infection. If left for re-colonization by other organisms before inoculation, the steamed soil becomes progressively less favourable for infection by the fungus.

When nitrogen was applied to inoculated allotment soil the result suggested that nitrogen starvation tends to confine *V. albo-atrum* to the roots of infected plants.

Further tests in which phosphorus and potassium were applied in addition to nitrogen indicated that phosphate did not influence the incidence of infection, but the figures suggest that potash deficiency may have increased susceptibility. Nitrogen deficiency appears to limit the eventual number of visibly diseased plants, not so much by preventing initial infection from the soil as by retarding fungal development within the vascular tissues. Nitrogen deficiency reduces both the severity of the disease and its incidence.

In a final experiment, the spread of the fungus from the roots of an infected

plant to those of neighbouring healthy plants was expedited by killing the infected plant.

Bailey (L. F.) & McHargue (J. S.). **Copper deficiency in Tomatoes.**—*Amer. J. Bot.*, xxx, 8, pp. 558–563, 2 figs., 1943.

An account is given of symptoms developing in tomato plants grown in culture solutions containing no copper. The optimum copper concentration for top growth was 0·05 p.p.m., and for fruits 0·01 p.p.m. The copper content of copper-starved plants was rather higher, on a basis of unit dry weight, than that of the copper-treated plants. Plants and portions of plants showing severe copper starvation contained relatively large amounts of copper, which was in an immobile state.

Lesley (J. W.) & Lesley (Margaret M.). **A hereditary variegation in Tomatoes.**—*Genetics*, xxvii, 5, pp. 550–560, 2 figs., 3 diags., 1942.

A variegation affecting an occasional tomato plant in field cultures at the Citrus Experiment Station, Riverside, California, is characterized by the superimposition of irregular, pale green areas on normal green stems and leaves. On a predominantly pale shoot, flower development is arrested, while in extreme cases the entire plant is sterile. The variegation was suspected to be of virus origin, but S. P. Doolittle's experiments in its transmission to healthy tomato and tobacco plants by rubbing and grafting gave negative results. The abnormality was found to behave as a dominant character, to be ordinarily inherited through the female parent, and apparently to originate in the cytoplasm.

Colquhoun (T. T.) & McCarthy (D. F.). **The Grand Rapids disease of Tomatoes.**—*J. Dep. Agric. S. Aust.*, xlvi, pp. 310–313, 4 figs., 1943.

Isolations from diseased glasshouse and outdoor tomatoes in South Australia constantly gave *Aplanobacter* [*Corynebacterium*] *michiganense* [*R.A.M.*, xxi, pp. 288, 420]. The control measures recommended consist in using seed from healthy plants, disinfecting with mercuric chloride any seed of uncertain origin, using clean soil for the seed-bed, marking affected plants during pruning and destroying them later on, washing the hands and implements with soap and water if contact with diseased plants during pruning is suspected, destroying plants at the close of the season (and not putting affected plants on the compost heap), and not planting tomatoes for two years in land suspected to be infected. So far the disease has made small headway in South Australia, where it appears to have been recorded in 1924 under the name of bacterial wilt by Samuel [ibid., v, p. 213].

Martínez (J. B.) & Del Cañizo (J.). **Spain. Forest pathology notes.**—*Int. Bull. Pl. Prot.*, xvi, 10, p. 133M, 1942.

During the first six months of 1942, the following were among the important investigations carried out at the Forestry Institute, Madrid. Poplar (*Populus nigra* var. *fastigiata*) groves consisting of five- to seven-year-old trees in the Burgos Province suffered from a die-back of the branches caused by *Dothiorella populnea*, not hitherto recorded from Spain. The mycelium develops in the living bark, and the stromata are fairly common in branches 1 cm. or less in diameter, in association with the saprophyte *Coniothecium radians*, the mycelium of which occupies the rhytidome.

Beeches in the Navarra Provinces were infected by *Hypoxylon coccineum*, *Bispora monilioides*, and *Schizophyllum commune*, the trouble being due to the impracticability of prompt clearance of the cut and decorticated logs, which have to remain for considerable periods on the ground in the forests. As a preventive, application of 15 per cent. zinc chloride to exposed parts on the timber is being made.

WAKSMAN (S. A.) & BUGIE (ELIZABETH). **Action of antibiotic substances upon Ceratostomella ulmi.**—*Proc. Soc. exp. Biol., N.Y.*, liv, 1, pp. 79–82, 1943.

The results of studies on the fungistatic and fungicidal action of various antibiotic substances on *Ceratostomella ulmi*, the agent of Dutch elm disease, showed actinomycin and clavacin to be strongly inhibitory, penicillin and streptothricin without effect, and fumigacin, hemipyocyanin, and gliotoxin intermediate. The anti-fungal activities of clavacin and more especially of actinomycin, the weaker of the two, could be partially overcome by the addition to the medium of certain nutrients, notably peptone [*R.A.M.*, xxii, p. 219].

BOYCE (J. S.). **Host relationships and distribution of conifer rusts in the United States and Canada.**—*Trans. Conn. Acad. Arts Sci.*, xxxv, pp. 329–482, 1943.

A critically annotated list of the rusts affecting conifers in the United States and Canada is preceded by an introductory note in which the writer states that the paper is based on his records of pertinent information relating to this group of fungi and covering the period of 25 years since the publication of the valuable work on the same subject by A. S. Rhoads *et al.* (*Phytopathology*, viii, pp. 309–352, 1918). Under each rust are given the synonymy, literature references, hosts, range, and critical remarks. The present study, which is supplemented by a bibliography of 558 titles, further includes *Gymnosporangium*, omitted from the earlier investigation. A number of exotic conifer rusts have been introduced into North America, in one case at least, that of *Cronartium ribicola* on white pine [*R.A.M.*, xxii, p. 543; xxiii, p. 122], with disastrous results. *C. flaccidum*, an injurious caulicolous parasite of *P. sylvestris* in Europe, was observed once in the uredo stage on Prince Edward Island in 1925, but apparently failed to secure a foothold. It constitutes, however, a potential threat to native hard pines. A third caulicolous rust conveyed to the American continent from Asia is *G. japonicum*, which occurs sporadically on the Pacific Coast. Foliicolous rusts similarly introduced but not generally established in America include *Chrysomyxa abietis*, *Coleosporium senecionis*, and *C. sonchi-arvensis* from Europe and *G. haraeanum* from Asia.

The transference of native rusts from one region of North America to another is also fraught with grave risks. For instance, *Cronartium fusiforme* might devastate the hard pines of the west if transported thence from its natural habitat in the south and south-east, while conversely, *C. filamentosum*, indigenous along the Pacific Coast and in the Rocky Mountain regions from Canada to the Mexican boundary, might be similarly destructive to eastern hard pines. The detection of the native foliicolous species, *Coleosporium campanulae*, *G. globosum*, and *G. juniperi-virginianae*, and the caulicolous *G. nelsoni* far from their natural habitats shows the possibilities of such dissemination to be actual.

RIVERA (V.). **Observations on Phytophthora cambivora, causal agent of the Chestnut ink disease.**—*Int. Bull. Pl. Prot.*, xvii, 4, pp. 49M–56M, 8 figs., 1943.

Cultural studies on *Phytophthora cambivora*, the cause of chestnut ink disease [*R.A.M.*, xxi, p. 475; xxii, p. 52], on sterilized wood of chestnut and other trees showed that some woods are compatible with the development of the mycelium of the fungus, particularly evaporated beech, beech, and poplar, whereas on others the mycelium will develop only if some specially suitable substance, such as malt, is added; such addition, however, does not induce development on chestnut, though by prolonged culture on chestnut sawdust and malt at 22° C. or more, a restricted growth of mycelium can be induced.

Not only has the wood of the plant most susceptible to the disease an almost inhibitive effect on the mycelium, such as is not possessed by woods of resistant plants, but also the tannic compound produced in the chestnut wood in the

presence of the fungus prevents any pronounced development of mycelium. This interpretation is supported by the fact that whenever appreciable growth occurred on chestnut sawdust with malt, 'ink' production occurred simultaneously with fungal development, while no 'ink' was produced when the mycelium failed to reach a certain degree of development. It is considered that ink production is a defensive reaction, though not usually an effective one.

In contrast with the wood, the cambium of the chestnut constitutes a highly favourable living medium for the growth of *P. cambivora.*

Other experiments demonstrated that the mycelium was devitalized by exposure to a temperature of 56° for 30 minutes or to 41° to 42° for 75 minutes, while growth was stimulated by exposure to the same temperatures for 20 and 60 minutes, respectively.

WILKINS (W. H.). **Studies in the genus Ustulina with special reference to parasitism VI. A brief account of heart rot of Beech (Fagus sylvatica L.) caused by Ustulina.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 169–170, 1 pl., 1943.

A heart rot typical of *Ustulina* [*vulgaris*: *R.A.M.*, xix, p. 497] was observed on a beech tree felled in the Botanical Gardens, Oxford, and on beech trees examined at Blenheim Park, Woodstock, Arundel Park, Sussex, and elsewhere. In the tree at Oxford, the rot extended up the trunk to a height of 12 ft., rendering the timber economically useless. In all the cases of heart rot of beech examined, as in most other heart rots caused by the same fungus, infection invariably took place through the decayed tap-root.

BADCOCK (E. C.). **Methods for obtaining fructifications of wood-rotting fungi in culture.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 127–132, 1 pl., 1 fig., 1943.

Using perfected methods of cultivation, the author induced fructification in 82 out of the 92 species of wood-destroying fungi cultured on a sawdust medium [*R.A.M.*, xxi, p. 176]. In general, the procedure was as follows: a tube packed fairly firmly with the sawdust medium and plugged with cotton wool is placed with its mouth downwards in a wide-mouthed flask, in which there is a wet pad, the space in the neck of the flask around the tube being filled with cotton wool. The entire apparatus is then sterilized in an autoclave for 30 minutes. Through a small hole previously made in the protruding bottom of the tube and kept plugged during sterilization, a transplant of fungus mycelium is now introduced, the small hole replugged and sealed down with plasticine. The mycelium grows along the tube and fructifications usually develop around the mouth of the tube within the flask. This method is stated to be very satisfactory for producing fruit bodies of *Trametes serialis.*

For fungi which do not form mature fruit bodies in the confined space of a flask, possibly owing to the absence of ultra-violet light or too high a humidity, the tube can be carefully removed from the flask as soon as the check in the development of the fruit body becomes apparent. The tube is laid across two Petri dishes, the one near the mouth of the tube being filled with water, and wet pads put both under the fruit body and on the plug of the tube. The water in the dish and the pads must not be allowed to dry out and the cultures should not be exposed to direct sunlight, the best growth being made in strong diffused light.

A more rapid method, involving, however, more risk of contamination, consists in filling large tubes with sawdust medium, autoclaving at 15 lb. pressure for $\frac{1}{2}$ or one hour (according to size), introducing the inoculum through a small glass tube in the large plug, plugging the small tube in turn, and placing the whole in an incubator in which moisture is maintained by the presence of a dish with water. After the mycelium has reached the ends of the tubes, they are removed from the

incubator and placed in the light on Petri dishes in the manner described above. Fruit bodies of *Pleurotus ostreatus* were obtained by this method.

The most rapid method of all is to remove the plugs entirely when the mycelium has grown half way down the tube and then to place a wet pad in the mouth of the tube just out of contact with the medium and later, when surface growth is vigorous, pushing the pad down so as to touch the medium. The tubes with the pads are then placed on Petri dishes containing water in such a position that the light falls on the open mouths of the tubes. When the fruit bodies of Agarics begin to develop it is best to stand the tubes vertically in baskets and to add a little water daily.

No single standard method can be expected to induce fructification in all wood-rotting fungi, but in general the following conditions appear to be essential: the provision of a generous supply of a rich, well-aerated medium with plenty of moisture; moderately high relative humidity, but not a saturated atmosphere, at the surface of the medium and around the developing sporophores; and exposure to light of moderate intensity.

Bavendamm (W.). **Über den Einfluss des Darrens von Holz auf seine Pilzanfälligkeit.** [On the influence of the kiln-drying of wood on its susceptibility to fungal infection.]—*Holz Roh- u. Werkstoff*, vi, 5–6, pp. 161–166, 1943.

As in previous investigations along the same lines, the writer found that beech and pine sapwood blocks kiln-dried at 105° C. were equally susceptible with comparable air-dried material to infection by *Coniophora cerebella* [*C. puteana*], *Stereum hirsutum*, *Merulius lacrymans*, *Daedalea quercina*, *Lentinus squamosus*, *Lenzites abietina*, and *Poria vaporaria*. *Polystictus versicolor*, however, constituted an exception to the general rule, being evidently particularly sensitive to the anti-fungal substances (e.g., fatty acids) formed in the process of kiln-drying. It caused 17·6 per cent. loss of weight in the air-dried pine blocks compared with 10·9 in the kiln-dried. Air-dried pine heartwood, on the other hand, was more extensively disorganized than the kiln-dried samples, especially by *P. versicolor*, the loss of weight due to which at the termination of the test after four months amounted to 3·8 per cent. for the former and 1·9 for the latter.

An adverse effect of kiln-drying on fungal growth only sets in at higher temperatures, i.e., 150° for pine and 175° for beech. At 200° the wood disintegrates and is highly resistant to fungal invasion, though the blocks continue to support profuse mycelial growth. At this temperature a faint odour of tar becomes discernible, pointing to the formation of distillates, the protective action of which is well known.

It was ascertained, in connexion with these experiments, that manual tests of the degree of fungal disorganization, which are sometimes impracticable, notably in the case of *S. hirsutum* on beech, may be supplemented by visual observations on the colour and consistency of the infected wood.

Schulze (B.). **Einheitliche Begriffsbestimmungen auf dem Holzschutzgebiet.** [Uniform definitions of concepts in the realm of wood preservation.]—*Holz Roh- u. Werkstoff*, vi, 4, pp. 141–142, 1943.

The writer has repeatedly been asked for explanations of certain terms in current use relating to wood preservation, the literature on which, in his opinion, abounds in ambiguities and contradictions. With a view to securing uniformity of interpretation, he therefore proposes the adoption of a number of standardized definitions for the various processes involved in the treatment of wood against insects, fungi, and fire, including osmosis, the application of appropriate preservatives with a colloid adjuvant (paste) to damp wood; live impregnation, the introduction of preservatives (into the wood) by way of the natural sap stream; and sap displace-

ment, the substitution for the sap in the green wood, with its bark still intact, of a preservative solution by means of hydrostatic pressure.

SOUTHAM (C. M.) & EHRLICH (J.). **Decay resistance and physical characteristics of wood.**—*J. For.*, xli, 9, pp. 666–673, 1943.

At the School of Forestry, Moscow, Idaho, the authors determined, on the basis of loss of oven-dry weight, the extent of decay caused by *Coniophora puteana*, the agent of a brown, cubical sap rot of peeled poles, on leached heartwood and sapwood and unleached sapwood of western red cedar (*Thuja plicata*) [*R.A.M.*, xxii, p. 159]. Sterilized blocks of uniform dimensions were placed in jars containing malt agar cultures of the fungus, which were incubated at room temperature, with intermittent diffuse illumination, for 6½ months. At the end of this period the mean weight losses for leached heartwood and leached and unleached sapwood were 26±0·96, 12±0·97, and 18±1·1 per cent., respectively. No correlation was apparent between weight loss and specific gravity or ring frequency, or between ring frequency and specific gravity. These data, though admittedly inconclusive, are published as a provisional contribution to the problem of the relationship between the physical properties of wood and decay resistance, further work on which by the writers is impracticable at the present time.

WALLACE (J. O.). **N.Z. Resistant Swede.**—*N.Z. J. Agric.*, lxvii, 5, pp. 341, 343, 2 figs., 1943.

The swede variety known in New Zealand as N.Z. Resistant is stated to be highly resistant to club root [*Plasmodiophora brassicae*] and less susceptible than others to wastage following initial infection with dry rot [*Phoma lingam*]. Of Danish origin, this variety was originally marketed under the name Wilhelmsburger Øtofte [*R.A.M.*, vii, p. 758]. Considerable quantities of seed of this late-maturing variety are now available in New Zealand.

OWEN (F. V.) & MURPHY (A.). **Progress with curly-top resistant varieties of Sugar Beets.**—*Fm Home Sci., Utah*, iv, 1, pp. 13–14, 1943. [Abs. in *Sugar*, xxxviii, 12, pp. 36–37, 1943.]

Sugar beet curly top control in Utah began with the introduction of the U.S. 1 variety, which contributed to some extent to the revival of the beet sugar industry though its bolting tendency and low sugar content were drawbacks to its cultivation. For a few years, U.S. 34 and U.S. 12, derivatives of U.S. 1 [*R.A.M.*, xxii, p. 85], were grown, but they have now been largely superseded by U.S. 22 and U.S. 33, of which the former is the more resistant, while the latter, with its higher sugar content, is preferred for areas of relatively mild infestation. Meanwhile the continued efforts of breeders have resulted in the development of an even more highly resistant line, Improved U.S. 22, seed of which is expected to be available for commercial plantings in 1944. In exacting tests it yielded 6·6 tons of beets compared with 14·3 and 6·3 for U.S. 22 and U.S. 1, respectively. The damage still inflicted even on resistant varieties in seasons of severe infection may be minimized by early planting, liberal manuring, and other appropriate cultural measures.

SCHULTZ (H.). **Untersuchungen über die Fusskrankheit der Ackerbohne.** [Studies on the foot rot of the Broad Bean.]—*Zbl. Bakt.*, Abt. 2, cvi, 1–4, pp. 38–50, 9 figs., 2 graphs, 1943.

Broad beans are not in general particularly susceptible to disease, but appreciable damage may be caused by foot rot, this having been the case, for instance, according to unpublished material of the Biological Institute, in Oldenburg in 1940 and 1941. It is usual to refer to the disease in question as 'foot rot and wilt', but the

two classes of symptoms rarely occur together and the malady should therefore preferably be termed simply 'foot rot'. A superficial resemblance to wilt may sometimes be observed, as for instance in the Dahlem experimental plots in August, 1942, when the foliage of plants inoculated with *Rhizoctonia* and *Pythium* spp. assumed a pale greyish-green, later brown tinge and the leading shoot drooped slightly; many plants died, the lower leaves turning black and shrivelling, while the upper ones showed only apical and marginal discoloration. The brown vascular discoloration, however, which is the typical feature of wilt, was entirely absent. Dark depressions appeared at an early stage on the stem base, and as infection progressed the whole stem tended to shrink, at the same time losing its normal green colour. The orange sporodochia of *Fusarium avenaceum* were frequently detected on the basal lesions. There were fewer pods on diseased than on healthy plants, and in early attacks the flowers fell prematurely; even after flowering infection reduced the yield to a minimum, except when it was delayed until just before ripening, in which case the crop was apparently normal. The roots of diseased plants were invariably more or less damaged, the brown discoloration spreading from the tips right along to the bases of the lateral roots. The host reacts to the invasion of the parasite by the formation of adventitious roots, thereby postponing or occasionally even averting ultimate collapse, though more often the pathogen gains the upper hand, especially under adverse conditions for the plant, such as drought, and proceeds to disorganize the tap-root, finally leaving only the central cylinder intact. In any case, the involvement of the root system is reflected in arrested growth and consequent reduction of yield.

Cultures on vegetable marrow agar from the root tissues of diseased Dahlem plants gave rise exclusively to *R.* and *P.* spp., but out of 11 plants sent from Landsberg (Warthe), seven yielded *R.* [*Corticium*] *solani*, two *F. avenaceum*, one the same fungus in association with *Botrytis cinerea*, and one *P. artotrogus*. Some of the strains of *C. solani* were characterized by a pale mycelium and sparse yellowish sclerotia, and others by a dark-coloured mycelium and typical dark brown sclerotia [*R.A.M.*, xv, p. 24].

Inoculation experiments were conducted in the greenhouse and field with water cultures and in artificially infected soil, using various strains of *C. solani*, *P. debaryanum*, four strains of *P. irregulare*, four of *F. avenaceum*, and single strains of *P. ultimum* and *P. mamillatum*. Positive results were secured with the four first-named fungi, of which *C. solani* is undoubtedly the most virulent pathogen, followed by *F. avenaceum*, *Pythium* being in general less injurious, though it is clear from the literature that certain species or strains of this genus are potential agents of severe infection.

Legislative and administrative measures. Spain.—*Int. Bull. Pl. Prot.*, xvii, 3, pp. 39M–40M, 1943.

By Decree of 19th September, 1942, relative to the manufacture of insecticides, fungicides, and material serving for their application, a central office register for such products has been established at the Phytopathology and Crop Pests Branch of the Spanish Department of Agriculture. Three months after the publication of this Decree, no product can be manufactured, sold, or circulated unless entered in the said register. Foreign products may be imported only if registered beforehand. The sale of phytosanitary products in bulk is prohibited. The products, on sale in ordinary receptacles, will be provided with a guarantee band and label in accordance with the official model, indicating the registration number of the product, the name of the manufacturer, and the chemical composition, the content of useful ingredients also being shown. All advertising matter concerning the usefulness and application of the product will be revised beforehand by the Department of Agriculture.

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CASS SMITH (W. P.). **Vegetable seed treatments.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xx, 3, pp. 210–216, 2 figs., 1943.

Short, practical directions are given in tabular form for the treatment of vegetable seed against common diseases, together with notes on the preparation and use of different fungicides.

STILLE (B.). **Der mikrobielle Verderb getrockneter Lebensmittel in Abhängigkeit von der relativen Luftfeuchtigkeit.** [The microbial spoilage of dried foodstuffs as conditioned by the relative atmospheric humidity.]—*VorrPfl Lebensm-Forsch.*, v, pp. 403–408, 1942. [Abs. in *Chem. Zbl.*, cxiv (ii), 10, p. 967, 1943.]

At the Naval Food Preservation Experiment and Research Station, Hanover, *Aspergillus glaucus* was shown to be extremely xerophile, being the last of the organisms tested to cease growth with declining atmospheric humidity; the germination and spore formation limits were 70 and 74 per cent. relative humidity, respectively, at the optimum temperature of 31° [C.]. In practical storage trials with unpacked dried vegetables at 31°, 77 per cent. relative humidity was the lower limit for risk of spoilage by *A. glaucus*. No other dried products are as sensitive to fungal damage as vegetables.

HICKMAN (C. J.) & ASHWORTH (D.). **The occurrence of Botrytis spp. on Onion leaves with special reference to B. squamosa.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 153–157, 1 pl., 1 fig., 1943.

A die-back disease of onion foliage characterized by pale spots and wilting, followed by death of the leaves from the tip downwards, and apparently restricted to the autumn and winter, was studied by the authors during 1941 and 1942. Three species of *Botrytis* were isolated from diseased leaves: *B. squamosa*, recorded for the first time in England, was present and predominant on ten occasions from widely separated localities; *B. cinerea*, which appeared only twice (once in association with *B. squamosa*); and a third, as yet unidentified, species. No experiments were carried out to test the pathogenicity of the fungi. The disease is believed to be a case of facultative parasitism, infection being governed either by increased susceptibility of the host during autumn and winter as a result of adverse weather conditions, by attack by downy mildew (*Peronospora schleideniana*) [*P. destructor*], with which the *Botrytis* infection is sometimes associated, and by the favourable effect of the relatively moist conditions on the growth of *B.* spp.

BLACKFORD (F. W.). **Downy mildew and powdery mildew of the Cucumber.**—*Qd agric. J.*, lvii, 3, pp. 164–165, 1 fig., 1943.

The two most destructive diseases affecting cucumbers in Queensland are downy mildew [*Pseudoperonospora cubensis*: *R.A.M.*, xxi, p. 317] and powdery mildew [*Erysiphe cichoracearum*: ibid., xx, p. 509]. Both are generally to be found in

every cucumber crop in the State; they nearly always occur together, and such dual infection often produces heavy losses. Of the two, *P. cubensis* is the more serious.

Infection of cucumbers by downy mildew can be prevented by spraying with home-made cuprous oxide mixture (3 gals. of stock solution per 40 gals. water), or a commercial equivalent. Spraying or dusting should be started soon after the plants have appeared above the ground, applications being made as often as may be necessary to keep the new growth covered. Both surfaces of the leaves should be thoroughly treated. Powdery mildew may be checked by dusting with equal parts of sulphur and hydrated lime, or using a wettable or colloidal sulphur. As this treatment kills the fungus, applications may be delayed until infection appears. To control both diseases together a combination mixture of a wettable or colloidal sulphur and home-made cuprous oxide or a commercial equivalent may be used, or a dual-purpose dust may be substituted.

DILLON WESTON (W. A. R.) & TAYLOR (R. E.). **An abnormal growth on Mushrooms.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 144–145, 1 fig., 1943.

A knob-like intumescence observed by the authors on the pileus of a cultivated mushroom [*Psalliota campestris*] is believed to be somewhat similar to those described for 'rose-comb' disease [*R.A.M.*, xvii, p. 791]. The mushrooms were grown in a garage where oil had been stored, a circumstance possibly conducive to the disease.

TEAKLE (L. J. H.), JOHNS (H. K.), & TURTON (A. G.). **Experiments with micro elements for the growth of crops in Western Australia. IX. Copper deficiency of Currants at Gingin and its correction.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xx, 3, pp. 171–184, 6 figs., 1943.

Currant and sultana vines at Gingin, Western Australia, developed an unthrifty habit of growth, which was ascertained to be due to copper deficiency in the soil [cf. *R.A.M.*, xxii, p. 246]. In five years currant vines had only just reached a height of about $2\frac{1}{2}$ ft. from ground-level. The stems were scarcely more than $\frac{1}{2}$ in. thick, and the bark was rough and unhealthy. The canes were short, internodal growth was greatly restricted, and the wood failed to mature normally. The leaves were small, pale, and only slightly indented. Experimental treatments demonstrated that the condition responded to applications of copper sprays or copper fertilizers, or to a combination of these. Replanted vines showed vigorous establishment on the sites of the old vines, when treated with copper. The treatment recommended is annual copper spraying and the use of copper-containing fertilizers; as a soil dressing an application of copper sulphate at the rate of 1 cwt. per acre should suffice for several years.

TISDALL (A. L.). **Drainage investigations in the horticultural soils of the Murray Valley.**—*Pamph. Coun. sci. industr. Res. Aust.* 113, 23 pp., 1 pl., 1 diag., 2 graphs, 1942. [Photo-lithographed.]

Unduly high water tables, with their attendant damage to horticultural plants both from waterlogging and the excessive absorption of the soluble salts accumulated in the root zone, have been a major problem in the irrigation areas of the Murray Valley for many years. Annual autumn surveys were made of the condition of sultana vines on three sites at the Merbein Station from 1938 to 1941, inclusive, on the basis of which the plants were divided into six categories, viz., (1) good: vines healthy, no salt injury; (2) fair plus: slight salt damage, generally to the leaf margins, with some premature defoliation, but sufficient pruning wood still being produced; (3) fair: growth stunted, canes inadequate for pruning, early leaf-shedding, sometimes weak 'second growth' of laterals; (4) fair minus: more

conspicuous stunting, canes reduced to about half the normal number and usually short, premature defoliation, and frequent 'second growth'; (5) bad: vines just alive, no satisfactory canes, all growth short and severely affected; (6) dead. In the first year of drainage (1939), no improvement was observed in the health of the vines as compared with the previous year, but in 1940 and 1941, there were progressively fewer vines in the fair minus, bad, and dead classes. It is concluded that in most of the local sandy loam and loam soils the reclamation of waterlogged areas by means of drains is not only practicable but economically sound. Those provided in the vine field were 6 ft. deep and spaced 44 or 88 ft. apart, the latter distance having been found perfectly satisfactory.

Woods (M. W.) & Dubuy (H. G.). **Evidence for the evolution of phytopathogenic viruses from mitochondria and their derivatives. I. Cytological and genetic evidence. II. Chemical evidence.**—*Phytopathology*, xxxiii, 8, pp. 637–655, 4 figs., 4 diags., 1943; 9, pp. 766–777, 1 fig., 2 graphs, 1943.

The writers consider that viruses may have been derived from constituents of the chondriosomes controlling variegations, rather than from pre-existing parasitic micro-organisms [cf. *R.A.M.*, xxi, p. 229]. In support of this theory, experiments are described in which a white mosaic-sectorial variegation of *Euonymus radicans*, apparently of the chondriosome-controlled type, was transmitted by grafting to a previously non-variegated stock of the same species. Further weight is lent to the hypothesis of the origin of viruses in plastic mutations by the predominantly matroclinous inheritance of both viruses and variegation.

In the second paper chemical evidence is provided of the occurrence of a ribose nucleoprotein in the plant plastid of the same general type constituting viruses. The resemblance of the chromoprotein complex from plastids to the complex as it occurs in the living plant was shown by the results of spectral analysis and by its chemical and physical characteristics.

Перечень вредителей, болезней и сорняков с.-х.—растений—объектов внешнего карантина, установленный для СССР на 1940 год. [List of pests, diseases, and weeds of economic plants—objects of external quarantine, approved for the U.S.S.R. for the year 1940.]—62 pp. Сектор карантина растений и Центральная карантинная лаборатория [Section Plant Quarantine and Central Quarantine Laboratory], 1940. [Received February, 1944.]

This list of pests and diseases of economic crops subject to quarantine restrictions in the U.S.S.R. supplies information on the host range, geographical distribution, and means of dissemination of the various parasites, which are arranged under the crop plants.

Ahlberg (O.), Lihnell (D.), & Wahlin (B. J. O.). **Nyare undersökningar över sjukdomar och skadedjur på fruktträd, bärbuskar och köksväxter.** [Recent investigations on diseases and pests of fruit trees, small fruits, and kitchen-garden plants.]—*Sverig. pomol. Fören. Årsskr.*, xliv, pp. 99–112, 1943.

The following items occur in this report, besides some noticed from other sources. In an attempt to economize in the use of copper, C. Stapel and H. Petersen (*Tidsskr. Planteavl*, xlvii, 1943) tested a number of copper, sulphur, and organic chemical fungicides in Denmark against apple scab [*Venturia inaequalis*] and potato blight [*Phytophthora infestans*]. Although giving adequate control of the former disease, the compounds tested were inferior to standard Bordeaux, while lime-sulphur sprays of the various copper compounds, though as effective as 1 per cent. Bordeaux mixture against the latter disease, were inferior to 2 per cent. Bordeaux.

N. F. Buchwald's inoculation experiments and conidial measurements (ibid., xlvii, pp. 521–528, 1943) yielded irrefutable evidence that *Sclerotinia fructigena* is the agent of a hazel nut [*Corylus avellana*] disease characterized by the profuse development of yellow fungal 'cushions' on the nuts, which fall prematurely.

Potato virus diseases are spreading to such an extent in Sweden [*R.A.M.*, xxii, p. 446] that their control is becoming a really grave problem for plant pathologists. In the summer of 1941 officials of the Plant Protection Institute visited 54 potato fields in different parts of the country, of which 36 were infected by viruses, many with up to 75 per cent. of the plants showing unmistakable symptoms. In 17 fields covering 9 ha. in the Linköping district, an average of 10 per cent. of the plants were affected by viruses, mostly of a severe type, and none of the fields was entirely healthy. In 1942 only four out of 112 fields (120 ha.) were free from virus diseases, of which mosaic occurred in 92, aucuba mosaic in 4, rugose mosaic in 92, streak in 13, and leaf roll in 34, the average incidence of infection being 36 per cent. (7 per cent. severe). Generally speaking, as in other countries, potato degeneration of virus origin is more prevalent in low-lying regions, such as Scania and Halland, and coastal districts than at higher altitudes and further inland. It also assumes a more virulent form in the south than in the north.

Annual Report, Cawthron Institute, Nelson, New Zealand, 1941.—35 pp., [? 1942]; **1942.**—32 pp., [? 1943].

In the first of these reports [cf. *R.A.M.*, xx, p. 559] it is stated that during 1940–1 the best control of magnesium deficiency of apple trees was associated with the use of magnesium carbonate at the rate of 2 lb. per tree. Chemical analyses of leaf samples from the experimental plots revealed slight increases in the magnesium content of the leaves as a result of the application of different magnesium top dressings. In the 1941–2 season further improvement was observed to follow in the treated trees, as a result of the dressings applied in previous seasons, particularly in Sturmer trees at Braeburn. Dolomite, 6 lb. per tree, markedly improved the foliage.

Kondine tomatoes and allied varieties in Nelson are affected by 'hard core', in which a high percentage of tough white or greenish-white tissue is present. Incidence appears to be influenced by seasonal and climatic factors. Records of 100 plants in one garden showed that every plant became affected. The first and second fruit bunches had a higher percentage of affected fruits than the bunches higher up while in many cases fruit from the top was relatively unaffected. On the whole, plants with the heaviest crop had the highest percentage of hard core. Of a number of chemicals injected into the stems of these plants, boron and magnesium acetate favoured the trouble, while ammonium chloride appeared to reduce its incidence.

No significant differences in the incidence of initial tobacco mosaic in the field were observed when the tobacco was planted on areas where the previous crop had been 'pulled' or, alternatively, 'disked in'.

In the second report it is stated that apple leaves showing the brown blotching characteristic of magnesium deficiency were shown to be low in this element by a colorimetric test. In 1942–3 still further improvement followed the applications of magnesium to the Sturmer apple trees at Braeburn. There appeared to be no advantage in increasing the amount of ground dolomite above 12 lb. per tree, whether this latter amount was used in one application or in two. The evidence obtained has proved the value of ground dolomite, magnesium carbonate, and magnesium sulphate in the treatment of magnesium deficiency, but three or four years must often elapse before satisfactory control results in badly affected orchards. Ground dolomite gave the most consistently good effects. Magnesium sulphate sometimes acted more rapidly, but the control obtained was less lasting.

The notification service in connexion with the ascospore maturity of apple brown rot [*Sclerotinia fructicola*] and black spot [scab: *Venturia inaequalis*] was continued for the benefit of growers in the Nelson area.

Tomato 'cloud' was favoured by steam sterilized soils. The amount of 'cloud' fruit was highest in the bottom bunch (14·1 per cent.), diminishing until the bunches above the fifth showed little if any signs of the trouble. The percentage of cloud in the Institute glasshouse was less on the eastern and southern sides than on the western and northern.

Further studies on tobacco mosaic showed that percentage incidence was higher among 'pricked out' than among 'bed sown' plants. Infection in the continuous tobacco and alternate oats–tobacco plots amounted to 2·3 and 1·8 per cent., respectively. The incorporation of tobacco trash in the soil of a seedling bed gave a comparatively high increase in infection. Inoculations of tobacco seedlings with soil suspensions from beds treated with tobacco trash five months before gave positive results. Milk spray (1 in 10 with water) afforded some protection in seedling beds.

BERTUS (L. S.). **Plant pathology.**—*Adm. Rep. Dir. Agr., Ceylon, 1942*, p. D5, 1943.

During the period covered by this report [cf. *R.A.M.*, xxii, p. 197], *Fomes lignosus* was observed, for the first time in Ceylon, as the agent of a root disease of cassava on [*Hevea*] rubber estates, where its occurrence on the food crops may be used as an indicator of the presence of infected roots and stumps.

A sap-transmissible virus was implicated in the etiology of a mosaic disease of vegetable marrow [cf. ibid., xxiii, p. 125] and snake gourd (*Trichosanthes anguina*).

Tomatoes also suffered from a virus disease causing leaf curl and stunting, which is communicable to healthy plants by means of grafting and whiteflies [Aleyrodidae], but not through the sap.

A disorder of young citrus, characterized by reduced growth and a 'staghorn' appearance of the plants, combined with debility and the presence of branching gum canals in the cambial zone, is somewhat reminiscent of exanthema [ibid., xi, p. 628 *et passim*].

Mycology.—*Rep. Dep. Agric. Burma, 1941–42* and *1942–43*, pp. 4–9, 1943.

During the periods under review [cf. *R.A.M.*, xix, p. 70] rice blast (*Piricularia oryzae*) was fairly prevalent in the Delta. The immersion of seedlings in a 2 per cent. copper sulphate solution before transplanting gave encouraging results.

The smut of *Sorghum dochna* caused by *Sphacelotheca sorghi* was effectively combated by four hours' soaking in water at room temperature followed by spreading and drying in a room; 15 minutes' immersion in 2 per cent. copper sulphate; and dusting with finely powdered sulphur, the three methods reducing the incidence of infection from 9 to 0·8, 0·2, and 0·1 per cent., respectively, while the comparative figure for drying in the sun (shade temperature of 106° F.) after immersion was 4 per cent.

The same host was severely attacked by sugary disease (*Sphacelia sorghi*) at Mandalay and Tatkon. The sclerotia of a species of *Claviceps* were detected among the dry grain used as cattle fodder, in some cases with fatal results.

Phytophthora colocasiae was responsible for a rather serious foot rot of *Piper betle*, destroying some 50 per cent. of the vines in one locality, where the timely application of 1 per cent. Bordeaux mixture arrested the further spread of the disease.

Some improvement in the health of onions attacked by *Alternaria* sp. was obtained by spraying the plants a week before and a month after transplanting with 1 in 2,500 copper sulphate.

Among the organisms associated with a coco-nut disease of the top-rot type,

causing losses of half the palms in some plantations, were a species of *Fusarium* and a Phycomycete. The first symptom is the wilting of the youngest leaves in the centre of the crown, followed by that of the surrounding foliage, with the exception of the oldest peripheral leaves. Affected palms cease to grow, no more fruits are produced, and those already formed shrivel, while the crown may be shed at an advanced stage. The rot attacks palms of all ages.

Storage of mangoes at 36° and 40° resulted in physiological breakdown of the fruit within a fortnight. A species of *Gloeosporium* and *Dothiorella* [*Botryosphaeria*] *ribis* caused lateral and stem-end rot, respectively, of the stored fruits. Storage temperatures of 36° and 40° were also unfavourable to mangosteens, which developed hardening of the rind and physiological breakdown within a fortnight; *Diplodia natalensis* was determined as the agent of stem rot. *Thielaviopsis* [*Ceratostomella*] *paradoxa* and *Rhizopus* sp. were the chief sources of loss among stored pineapples.

The following were observed for the first time in Burma: *P. colocasiae* on *Colocasia* sp., and a species of *Nematospora* and *A. citri* on mandarin orange fruits.

The inoculation of trap pits with *Metarrhizium anisopliae* reduced the number of living grubs of the rhinoceros beetle [*Oryctes rhinoceros*] pest of coco-nut by 15 per cent. in one locality and 70 per cent. in another.

The straw mushroom (*Volvaria diplasia*) continued to find favour among cultivators [ibid., xx, p. 100].

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liv, 11, pp. 503–506, 4 figs.; 12, pp. 559–564, 9 figs., 1943.

In these notes on plant diseases in New South Wales it is stated that leaf mould [*Cladosporium fulvum*: *R.A.M.*, xxii, p. 281] is locally one of the most serious diseases of glasshouse tomatoes. Infection can be reduced by regulating watering and ventilation so as to lower the humidity, but the only effective spray is shirlan A.G. (1 pint per 40 gals.). Spraying should be started a few weeks after transplanting, and should be continued at fortnightly intervals for as long as is practicable. Destruction of the mould by sulphur fumigation (1 lb. per 1,000 cu. ft.) before clearing out the old vines is preferable to fumigating cleaned houses.

Sweet potatoes are attacked by scurf or soil stain (*Monilochaetes infuscans*) [ibid., xxii, p. 419]. New records include *Sclerotinia sclerotiorum* on *Chrysanthemum cinerariifolium*, *Cephaleuros mycoidea* [ibid., xx, p. 111] on citrus, *Septoria cucurbitacearum* [ibid., xvii, p. 364] on cucumber, *Rhizoctonia* [*Corticium*] *solani* causing crown and root rot of *Gerbera jamesonii*, and pea enation [mosaic] virus on peas.

The chief virus diseases causing deterioration of potatoes in Australia are leaf roll, virus X, virus A, and virus Y. Virus X is present throughout all commercial varieties. The Factor potato, which is that most commonly grown in New South Wales, possesses field immunity from virus A, and accordingly does not show symptoms of crinkle and related forms of mosaic, but the Snowflake, Carman, and Brownell varieties are susceptible and the combination of viruses A and X in these varieties leads to the development of mosaic symptoms. Aucuba mosaic (virus F) is sometimes found in New South Wales. To eliminate strains of virus X from the local seed stocks the existing stocks will have to be entirely replaced [ibid., xxii, p. 468].

During the spring of 1943 late blight of potatoes [*Phytophthora infestans*] developed in epidemic form in some coastal areas. To retard the development of infection during storage the tubers should be kept at 38° F. or less.

Heavy losses were caused to cherry growers as a result of attack by brown rot (*Sclerotinia fructicola*) [ibid., xxi, p. 244; xxii, p. 470]. Recommendations for control include stringent plant sanitation combined with spraying just before or at budswell with Bordeaux mixture (6–4–40) or lime-sulphur (1 gal. to 20 gals. water).

Further treatments should be applied at blossoming, at 'shuck-fall', and at intervals of three to four weeks from shuck-fall until harvesting; if the weather is very humid, spraying should be effected during the seven days before harvest. Sprays may also be applied to cherries between pickings. At three stages the following sprays are recommended for all stone fruits except early peaches and apricots in coastal areas: lime-sulphur (1 gal. to 160 gals. water), colloidal sulphur (2 lb. to 100 gals.), or wettable sulphur (5 lb. to 100 gals.). Early peaches in coastal districts should be treated only with colloidal or wettable sulphur. Early apricots in the same localities should be sprayed with Bordeaux mixture ($1\frac{1}{2}$–1–80 plus $\frac{1}{2}$ gal. white oil) or with copper oxychloride ($\frac{1}{2}$ lb. to 80 gals. plus $\frac{1}{2}$ gal. white oil).

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 11, pp. 551–555, 558, 8 figs., 1943.

During 1942–3 broad bean seed crops in Victoria were heavily infected by anthracnose due to a species of *Ascochyta*, probably *A. fabae* [*R.A.M.*, v, p. 699; xi, p. 143]. The disease was particularly serious in the Geelong area, some crops at Leopold, Wallington, and Drysdale showing 100 per cent. infection. Infected plants bear dark brown, circular or oval dead areas up to $\frac{1}{2}$ in. in diameter on the leaves, the lower leaves being usually most severely affected. The spots often develop growth rings in the form of concentric circles; the pycnidia are present in the central ring. The pods are attacked as they form, and show conspicuous dark brown or black, circular, sunken spots, which may unite, destroying most of the pod surface. Finally a flesh-pink mass of spores develops in the centre of each lesion. The fungus penetrates the seed through areas in contact with the pod. Infected seeds show brown, circular markings on the coat, sometimes with the concentric ring formation, which is also present on the pods. In affected areas seed should be used that has been obtained from an arid locality where the disease is not likely to develop. A three years' rotation should be adopted, and refuse from all diseased crops burnt.

Tomato spotted wilt is more prevalent in the Melbourne area than in any other part of Victoria. This is attributed to the large number of infected hosts (especially ornamentals) growing in the metropolitan area. Over 50 per cent. infection is not unusual. Both vectors, *Thrips tabaci* and *Frankliniella insularis*, are present. Experimental evidence did not indicate that a tartar emetic-brown sugar spray gives satisfactory control [ibid., xxii, p. 115]. Commercial growers are advised to rogue out and replace diseased plants and practise clean cultivation. It is advisable to plant two tomatoes to each stake, so that if one becomes infected it can be replaced; it is very seldom that two plants on one stake are attacked simultaneously.

Plane trees [*Platanus*] in Victoria are frequently affected by leaf scorch (*Gloeosporium nervisequum*) [ibid., xii, p. 735; xix, p. 444; xx, p. 611]. Pollarding plays an important part in control, since it removes the infected twigs in which the fungus overwinters. The prunings should be burnt, and the trees sprayed with Bordeaux mixture (4–4–40) at bud-burst and about a week later. In wet seasons further applications should be made at fortnightly intervals.

Science for the farmer.—*Rep. Pa agric. Exp. Sta., 1942–43* (*Bull.* 446), 44 pp., 16 figs., 1943.

This report [cf. *R.A.M.*, xxii, p. 238] contains the following items of phytopathological interest. C. F. Noll states that the 90A–27 oats variety is resistant to smut [*Ustilago avenae* and *U. kolleri*]; it is widely grown in certain parts of Pennsylvania, a considerable acreage having been certified for seed during the past few years. Beaver, a selection from 90A–27 also developed by Dr. Noll, was released for distribution in 1943.

Certain strains of potatoes immune from blight [*Phytophthora infestans*] and selected by W. R. Mills have shown sufficient promise in trials at the State College to be placed in regional tests.

ELLIOTT (CHARLOTTE). **Recent developments in the classification of bacterial plant pathogens.**—*Bot. Rev.*, ix, 10, pp. 655–666, 1943.

Recent important contributions to the taxonomic study of bacterial plant pathogens are summarized: most of the work referred to has been noticed from time to time in this *Review*.

THOMAS (J. E.) & RIKER (A. J.). **The influence of known chemicals on the initiation of pathological growth and symptoms resembling those from certain viruses.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1119, 1943.

Of 31 chemical compounds mixed in a lanoline paste and applied to the decapitated stem tips of sunflower, marigold, tomato, Paris daisy [*Chrysanthemum frutescens*], velvet leaf, *Kalanchoë*, and *Bryophyllum pinnatum* plants $1\frac{1}{2}$ to 2 in. above inoculations with the attenuated strain of *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xvii, p. 798; xviii, p. 580], 12 were found to be capable of 'activation' of the tissues surrounding the sites of inoculation, the most powerful being indole-butyric acid, alpha naphthylacetamide, and beta-naphthoxyacetic acid. Common responses to treatment with the growth substances included axillary bud and abscission layer inhibition, aerial root stimulation, stem-thickening, epinasty, gall formation, and foliar distortions, the last-named presenting close similarities with certain disorders of virus origin; they were, however, not transmissible to healthy plants and recovery eventually took place.

CONN (H. J.). **Validity of the genus Alcaligenes.**—*J. Bact.*, xliv, 3, pp. 353–360, 1942.

At present only one soil bacterium has been referred to the genus *Alcaligenes*, viz., *A. radiobacter*, and it is obviously out of place here if the type species, *A. faecalis*, an intestinal organism requiring organic nitrogen, be accepted. On the other hand, *A. radiobacter* closely resembles the legume nodule bacteria (*Rhizobium* spp.) and those responsible for crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) and hairy root (*P.* [*Bact.*] *rhizogenes*). For the accommodation of these nearly related species, and others that may be found similar in morphology and physiology, the new genus *Agrobacterium* is proposed, with *A. tumefaciens* as the type species. It is characterized by small, short, non-spore-forming rods, typically motile by 1 to 4 peritrichous flagella and occurring primarily in the soil or as pathogens attacking roots or causing stem hypertrophies. The organisms comprising this group are usually Gram-negative, produce no acid or gas in glucose-peptone media, and liquefy gelatine slowly or not at all.

ANDERSON (H. W.). **Action of clavacin on certain phytopathogenic bacteria.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1109, 1943.

Clavacin, an antibiotic substance derived from *Aspergillus clavatus* [*R.A.M.*, xxii, p. 91], was tested for its antagonism to 20 species of bacteria in dextrose broth, comprising seven of *Xanthomonas*, five each of *Pseudomonas* and *Corynebacterium*, two of *Agrobacterium*, and one of *Bacterium* (*Bact.* [*X.*] *stewarti*), the sterile, unconcentrated filtrate used for this purpose containing four Oxford units per ml. Four of the organisms were killed at a strength of 2 per cent. or less, nine at 4, and two at 6, the remaining five surviving but undergoing bacteriostasis at 4 per cent. Clavacin further exerted a bacteriostatic action on 10 of the 20 test species at 1 per cent. or less and on seven at 2 to 3 per cent. The Gram-negative *X. stewarti* and *X. pruni* (which is refractory to penicillin) were the most sensitive to contact with

clavacin, and *Staphylococcus aureus*, included for comparison, responded in a similar manner.

NEISH (A. C.) & HIBBERT (H.). **Studies on plant tumours. Part II. Carbohydrate metabolism of normal and tumor tissues of the Beet root. Part III. Nitrogen metabolism of normal and tumor tissues of the Beet root.**—*Arch. Biochem., N.Y.*, iii, 2, pp. 141–166, 1 graph, 1943.

A comparative study at McGill University, Montreal, of respiration, fermentation, and the Pasteur effect (defined by some workers as the effect of oxygen in inhibiting production of the fermentation product, and by others as the effect of oxygen in decreasing the rate of carbohydrate catabolism of fermenting tissue) of normal and crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) beetroot tissues [*R.A.M.*, xx, p. 154; xxii, p. 423] revealed, *inter alia*, the conversion of 75 per cent. of the carbohydrate to unknown substances by the tumour tissue, in which alcoholic fermentation is active and lactic acid fermentation absent; the presence of a well-developed Pasteur effect in both tissue types; the increased tendency of tumour tissue to synthesize proteins, primarily under aerobic conditions (this applies also to healthy material); the replacement by both tissue types of glutamine by asparagin; and the partial fixation of amide nitrogen by both types.

LEVI (I.), MICHAELIS (M.), & HIBBERT (H.). **Studies on plant tumours. Part IV. Oxidases in normal and tumor Beetroot tissue.**—*Arch. Biochem., N.Y.*, iii, 2, pp. 167–174, 1943.

The influence of dihydroxymaleic and ascorbic acids, catechol, hydroquinone, and resorcinol on the oxygen consumption of normal and crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) tissue [see preceding abstract] was investigated. An increased oxygen uptake was observed with all the substances except resorcinol, which inhibits catechol oxidase in both types of tissue. The increased ascorbic acid content of the galls is in part explained by their reduced ascorbase content.

THOROLD (C. A.). **Witches' broom disease investigations. VII. Observations on direct control.**—*Trop. Agriculture, Trin.*, xx, 12, pp. 239–241, 1943.

In a small experiment carried out in Trinidad on the direct control of cacao witches' broom (*Marasmius perniciosus*) [*R.A.M.*, xxiii, p. 9], six blocks each of 144 trees of one budded clone or of the same number of seedling progeny from one individual tree were divided into two equal plots of 72 trees. In one half of each block the brooms were removed once every month for two and a half years, while in the other half they were left on the trees. A total of 488 brooms formed on the trees from which the brooms were removed, as against 440 on those on which they were allowed to remain. The treatment thus gave no control.

To ascertain whether there was any evidence for the view that neglected neighbouring fields may be detrimental to an estate where broom removal is carried out, observations were made in six fields on the Non Pareil estate. The results showed that the highest percentage of diseased pods (24·5 per cent.) occurred in a field entirely surrounded by neglected properties, but the field with no neglected neighbours had 19·2 per cent. diseased pods, while two other fields partially bounded by neglected ones had only 16·3 and 18·5 per cent. infection, respectively.

Butter-fat content of 'black' Cacao.—*Bull. imp. Inst.*, xli, 4, pp. 234–236, 1943.

Preliminary experiments were carried out by J. West, Botanist to the Department of Agriculture, Nigeria, to determine the effect on the butter fat and free fatty acid content of cacao beans of the black pod disease caused by *Phytophthora palmivora*. The analysis of ten fermented samples of healthy and infected beans (five of each) from individual trees in a single experimental area showed the butter fat content

of the latter to be uniformly higher than that of the former. In another test on random samples of beans from sound and dead pods a similar result was obtained, but no difference was detected between the free fatty acid (as oleic acid) contents of the two lots.

GREANEY (F. J.) & MACHACEK (J. E.). **Seed-borne diseases of cereals in Manitoba—a survey, 1937–1942.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1111, 1943.

Among the many fungi isolated from samples of wheat, oats, barley, and rye seed-grain collected yearly in Manitoba from 1937 to 1942 were *Helminthosporium sativum* on wheat [cf. *R.A.M.*, xx, p. 566], barley, and rye, *H. avenae* on oats, and *H. teres* on barley, these being the predominantly pathogenic species. Oats in particular commonly yielded several harmless species of *Fusarium*. Soil-bed tests demonstrated a high positive correlation between the percentage of seeds attacked by *H. sativum* and *H. avenae* and the incidence of disease in the subsequent seedling stand. In wheat, but not in barley, seed infection by *H. sativum* coincided with low germination. Of the wheat samples tested 96·4 per cent. were virtually free from surface-borne smut [= bunt (*Tilletia caries* and *T. foetida*): loc. cit.], whereas the spore loads of smut on over 80 per cent. of the oats [*Ustilago avenae* and *U. kolleri*] and barley [*U. nuda* and *U. hordei*] were sufficiently high to necessitate seed treatment. Each year nearly half (46 per cent.) of the wheat seed stocks required treatment for disease control.

CARROLL (P. T.). **Some factors influencing lodging in cereals.**—*J. Dep. Agric. Eire*, xl, 2, pp. 280–285, 1943.

In this broadcast talk the author gives notes on the resistance of wheat, oats, and barley varieties to lodging, and advocates crop rotation to avoid the increase and spread of root-rotting fungi which endanger the standing power of the crop.

FISCHER (G. W.). **Some evident synonymous relationships in certain graminicolous smut fungi.**—*Mycologia*, xxxv, 6, pp. 610–619, 4 figs., 1943.

In this paper the author calls attention to instances of synonymy in the grass and cereal smuts, and recommends desirable consolidations. Fischer and Holton recently recommended uniting *Ustilago avenae* (causing loose smut of oats) and *U. perennans* (smut of *Arrhenatherum elatius*) [*A. avenaceum*] because of their demonstrated genetic relationship and morphological identity [*R.A.M.*, xxi, p. 11]. Further work has now shown that *U. nigra* should be included in the consolidated species [ibid., xxii, p. 298]. The legitimate binary name under the provisions of the International Rules would appear to be *U. avenae*, though *U. nigra* would be more descriptive. *U. hordei* and *U. kolleri* are morphologically not distinct, and should be regarded as specialized varieties of a morphological species which by priority should be designated *U. hordei*. *U. tritici* and *U. nuda* are identical in all respects except pathogenicity, and should be regarded as specialized varieties of the same morphologic species, which by priority should bear the name *U. tritici*. The author's studies also indicate that *Urocystis tritici* and *U. agropyri* are not morphologically separable, while *U. occulta* is fairly distinct because of the incomplete investment of the spore balls. Otherwise, the three 'species' are inseparable on the basis of size and shape of spore balls, number of spores contained in them, and size and shape of the spores. *U. agropyri* has been present in the United States for several decades, and over 30 species in 10 genera of grasses are known to be hosts. Herbarium specimens of flag smut under the name *U. agropyri* from all 10 genera of grasses were examined, and more variation was observed among the collections of *U. agropyri* than between the species as a whole and *U. tritici*. As *U. agropyri* and *U. tritici* are morphologically identical, it appears logical to consider them as one species. If flag smut of wheat were to continue to be considered as a separate

species, then the smut on each of the ten other genera of grasses would also merit specific distinction. The result would be nearly a dozen 'species' causing flag smut, none of them, probably, separable morphologically. In view of this, and considering that several species of grasses are susceptible to *U. tritici* [ibid., xxi, p. 293], it is recommended that this species and *U. agropyri* should be combined under the latter name, which has priority. It might even be desirable to include *U. occulta* in the composite species, but at present it appears preferable to keep it separate because of the incomplete investment of the spore balls by the sterile cells.

WOOLFORD (B. C.). **Deep South gets new, anti-rust recruits.**—*Sth. Seedsm.*, vi, 10, pp. 9, 53, 57, 2 figs., 1943.

Austin soft red winter wheat (selection 41-16-3-3 of the Texas Agricultural Experiment Station), derived from a single plant of a cross between Hope spring and a pure line strain of Mediterranean winter, is highly resistant to stem and leaf rusts [*Puccinia graminis* and *P. triticina*] and loose smut [*Ustilago tritici*].

Tunis barley has consistently showed high resistance to leaf rust [*P. anomala*]. A new smooth-awned barley named Texan, resistant to mildew [*Erysiphe graminis*] and stripe [*Helminthosporium gramineum*], is now being increased for distribution to growers.

Seed of the new Ranger and Rustler oats [*R.A.M.*, xxiii, p. 98] resistant to crown rust [*P. coronata*] is now available from a number of sources in Texas. Verde, the offspring of a double cross possessing a high degree of resistance to crown rust and withstanding stem rust [*P. graminis*] fairly well, but not very winter-hardy, should be ready for the market in the autumn of 1944.

LINDFORS (T.). **Är Berberislagen ineffektiv?** [Is the Barberry law ineffectual?]—*Landtmannen, Uppsala*, xxvii, 49, pp. 1040-1041, 1943.

During the four years since the outbreak of war the scarcity of farm labour in Sweden has resulted in a profuse new growth of barberries, mostly in the form of small plants which have sprung up either from seed, or more commonly from the surviving roots of 'eradicated' bushes. If the young growth is permitted to flourish for another few years, the position as regards its extermination will revert to that obtaining at the outset of the barberry eradication campaign [against *Puccinia graminis*: *R.A.M.*, xiii, p. 84]. In this connexion attention is drawn to some anomalies in the application of the existing regulations and a plea made for amendments to insure uniformity of interpretation over the whole country.

TYNER (L. E.) & BROADFOOT (W. C.). **Field tests of the differential reaction of Wheat varieties to root rot.**—*Sci. Agric.*, xxiv, 4, pp. 153-163, 1943.

In tests carried out since 1932 at Edmonton, Alberta, on varietal resistance in wheat to the root-rotting fungi *Helminthosporium sativum*, *Ophiobolus graminis*, and *Fusarium culmorum* [*R.A.M.*, xx, p. 397], the method of natural soil infestation by continuous cropping to wheat was adopted. Thus, the infection rating data obtained were indicative of the root-rot complex. One hundred seeds per 12 ft. row were planted at a depth of 2 in. In every tenth row Marquis wheat was planted as a guide in estimating the amount of heterogeneity in the experimental area. The planting dates varied, the mean being about 1st May. Notes were made during the ten days preceding maturity by cutting down crowns longitudinally and estimating disease severity on a percentage basis according to the relative degree of lesioning present in the crown tissue, and by examining the lesioning present in the other parts of the root system. In this way, the identification of inherent resistance was based on actual disease symptoms, not on yield.

The data obtained showed that, in spite of the influence of climatic factors on infection, some of the 148 varieties tested did appear to display more inherent

resistance than others, particularly Red Fife, Kota, O.A.C. 35, White Russian, Blue Ribbon, Huron, Kitchener, Double Cross, Caesium, Kubanka, Red Russian, Swedish, Major, McMurachy's Selection, and White Head. Drought markedly influenced the final rating. Early drought, by destroying parts of the root, opens the way for soil-borne pathogens and saprophytes. Drought experienced towards ripening produces a discoloration of the crown tissue distinguishable with difficulty from root rot. In general, the inherent resistance of a variety can be more accurately estimated 4 to 7 days before maturation than during the seedling stage or in the intermediate period, because maximum symptom development takes place just before maturity.

It is important that all varieties should be planted at the same time, so that they may be subject to like conditions during most of the growing period, the harvesting being done at intervals of three or four days, corresponding to the dates of ripening.

As regards the comparative value of greenhouse and field tests for resistance, it is pointed out that in the former it is easy to bring about the death of all the seedlings, by increasing the inoculum, or to induce only very light infection, by decreasing it, neither of which is satisfactory. Under such artificial conditions the behaviour of the pathogen becomes much more erratic than it is in the field, where the soil microflora is more stabilized. Also, under greenhouse conditions, seedling material (which is unsatisfactory for resistance studies) cannot be brought to natural maturity. Under field conditions, on the other hand, in naturally infested soil, infection of the host develops more gradually, and later in the post-seedling stage, though the plants mature more or less normally. However, even under field conditions, if inoculum is applied as a spore suspension on the seed, or is put into the drill in other forms, severe infection may develop, and a high percentage of the seedlings be killed before or soon after emergence; in this way, the remaining plants, having less competition, become abnormally vigorous. Hence, the difference in numbers of surviving seedlings is of doubtful value as an indication of resistance. For these reasons it would appear to be essential that tests for varietal resistance should be carried out only under field conditions in naturally infested soil.

Greaney (F. J.) & Wallace (H. A. H.). **Varietal susceptibility to kernel smudge in Wheat.**—*Sci. Agric.*, xxiv, 3, pp. 126–134, 1943.

Varietal tests conducted at several stations in Manitoba, Saskatchewan, and Alberta from 1935 to 1942 showed that, in general, varieties of *Triticum durum* were considerably more susceptible to kernel smudge, caused by *Alternaria* spp. [*R.A.M.*, xxi, p. 121] and *Helminthosporium sativum* [ibid., xxii, p. 297], than were those of *T. vulgare.* The varieties of hard red spring wheat tested ranked in order of susceptibility as follows: Apex, Thatcher, Marquis, Renown, Regent, and Garnet, an early-maturing variety which was highly resistant. Of the stem rust [*Puccinia graminis*]-resistant varieties tested, Apex and Thatcher were more susceptible than Renown and Regent. Extensive plating tests conducted with a large number of Manitoba samples of Apex, Thatcher, Renown, and Regent seed from crops of four seasons, 1939 to 1942, showed that Apex and Thatcher were slightly more susceptible to internal seed infection by the kernel smudge fungi than were Renown and Regent. Only a small proportion of the internally infected kernels exhibited external discoloration typical of smudge, indicating that although favourable conditions for infection of wheat kernels occur in Manitoba, those prevailing subsequent to infection are usually not conducive to the development of the disease.

Taylor (J. W.) & Harlan (H. V.). **Agronomic smut.**—*J. Hered.*, xxxiv, 10, pp. 309–310, 1943.

In two plantings at Aberdeen, Idaho, of Nakano Wase barley, using seed grown at Arlington, Virginia, one from central and the other from lateral kernels of the

same spikes, the incidence of loose smut [*Ustilago nuda*] in 1937 and 1938 was much higher in the latter than in the former (20·4, 10·6, and 15·1 compared with 6, 5·7, and 2·8 per cent. in the varieties Nakano Wase 51, 33, and 68, respectively). Esaw, a hybrid of Nakano Wase, reacted similarly with 7·5 per cent. smutted heads from the lateral as against 1·5 from the central kernels. In 1938 and 1939 large and small seeds of Nakano Wase 68 were separated by the Tyler screen and Hero fanning mill, respectively. In the former year the percentages of smut in heads from the small, medium, and large seeds were 17·5, 9·3, and 0, respectively, and in the latter, 17·3 to 19·6, 6·2, and 5·5, respectively. Very little smut occurred in Wisconsin Winter, in which the lemma and palet of the lateral kernels are interlocked or overlapped, the incidence in the heads from small and medium seeds being 2·6 to 3·1 and 1·4 per cent., respectively. The lateral flowers mature later than the central, thus permitting greater likelihood of infection, but this difference is not considerable except in such varieties as Nakano Wase, where the lemma and palet are open at flowering.

STAKMAN (E. C.), LEVINE (M. N.), & LOEGERING (W. Q.). **Races of Puccinia graminis avenae in the United States.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1118, 1943.

Races 1, 2, and 5 of oat stem rust (*Puccinia graminis avenae*) were until recently the only ones of serious importance in the United States. In 1940 and 1941, however, races 8 and 10 became increasingly prevalent, while in 1943 the widely distributed 8 comprised some 12 per cent. of all isolates and was responsible for substantial infection on Vicland, Boone, Tama, and other hitherto resistant varieties, mostly derived from Victoria × Richland crosses [*R.A.M.*, xxi, pp. 330, 441]. This race, together with 7, 10, and 12, which are also dangerous, was first detected in barberry-infested areas. Richland and White Tartar, the former susceptible only to races 8 and 10, and the latter to 7 and 12, have up to the present been largely used as parents in the breeding programme. The virulent races 4 and 6 have not yet been found in the United States, though occasionally recorded from Canada.

MEAD (H. W.). **Seed-borne molds of Barley.**—*Commun. Wallerstein Lab.*, vi, 17, pp. 26–32, 1943. [Abs. in *Chem. Abstr.*, xxxvii, 22, pp. 6815–6816, 1943.]

The examination of Canadian and United States barley seed-grain samples revealed the presence of bacteria and fungi, the latter including smuts [*Ustilago hordei*, *U. nuda*, and *U. nigra*], agents of root rot, e.g., *Fusarium* [and *Helminthosporium*] spp., and saprophytic moulds. The smuts do not impair the germination of the seed, but in large quantities they may induce an objectionable flavour in the malt. The root rots cause seedling blight and often prevent germination, while some *F.* spp. spread rapidly on the malting floor. The species responsible for scab [*Gibberella zeae*] is toxic to man in the seed-borne form. Germination may be substantially lowered by *Penicillium* and *Rhizopus*, which also cause rotting and adversely affect the taste of the barley. *P.* and *Aspergillus* utilize the carbohydrates of malt kernels, thereby reducing the available extract. They also spoil the appearance of the malt, but do not seem to induce any loss of palatability in the beer made from it.

DILLON WESTON (W. A. R.). **Diseases of Corn crops.**—*J. Minist. Agric.*, l, 11, pp. 496–499, 1944.

During 1943 some of the later-sown barley in Britain was seriously affected with mildew [*Erysiphe graminis*], while yellow rust [*Puccinia glumarum*] was in many instances exceptionally severe on wheat. The resistance of Rivet wheat to *P. glumarum* almost amounts to immunity, and Little Joss, once past the seedling stage, is strongly resistant; very severe infection was, however, noted on Desprez

80 in southern districts. Take-all [*Ophiobolus graminis*] of cereals was prevalent, but not particularly severe. In East Anglia oats appear to be immune, and could therefore replace barley in the rotation. A take-all disease of oats occurs in Wales, northern England, and in Scotland, but is seldom serious; it is caused by a strain of *O. graminis* [*O. graminis* var. *avenae*: *R.A.M.*, xx, p. 159] which is able to attack wheat or barley to some extent, though the strain which attacks wheat or barley does not attack oats.

To obtain maximum corn yields and avoid losses from disease, farmers should choose a variety suited to the soil texture and the standards of fertility, should disinfect all seed corn (both winter and spring corn) before sowing with an approved organo-mercury seed dressing, and should prevent take-all by starving out the fungus in the soil by means of a suitable rotation.

Piper (C. S.). **Manganese deficiency in Oats.**—*Nature, Lond.*, cliii, 3876, p. 197, 1944.

Referring to Twyman's recent communication on manganese deficiency of oats [*R.A.M.*, xxii, p. 428], the author states that the work of Stout and Arnon on the effect of molybdenum on the growth of tomatoes was confirmed by him with regard to oats [ibid., xix, p. 727], so that the response obtained by Twyman to his group of seven elements cannot be separated from the response known to be due to one of them. In critical water-culture experiments careful consideration must be given to the chemistry of the elements under investigation, so as to appreciate possible sources of contamination by them, effective means of removing them, and specific tests to demonstrate their absence. The amounts of the trace elements contained in the seed become of prime importance once satisfactory control of all reagents and water has been obtained.

In reply to these views Twyman (p. 198) states that the main purpose of his communication was to direct attention to the value of the Arnon technique. While there is no doubt that molybdenum is essential to the growth of oats, it remains to be proved whether one or more of the other elements of Arnon's original B_7 group were also responsible for at least part of the response obtained in Twyman's experiment. The word 'aluminium' in Twyman's paper should read 'chromium'.

Wang (C. S.). **Studies on cytology of Ustilago crameri.**—*Phytopathology*, xxxiii, 12, pp. 1122–1133, 2 pl., 1 fig., 1943.

The mature chlamydospore of *Ustilago crameri*, the agent of millet [*Setaria italica*] smut [*R.A.M.*, xviii, p. 174], has a diploid nucleus, but each promycelial cell is usually occupied by one haploid nucleus in consequence of reduction division; the chromosome numbers of the diploid and haploid phases are four and two, respectively. Meiosis appears to occur not only in the first division, but also frequently in the second and occasionally in the third. Binucleate hyphal cells predominate in culture and in the host throughout the life-cycle until an advanced stage of chlamydospore formation, when the two haploid nuclei of opposite sex fuse, leaving one diploid nucleus. In the plant chlamydospores are produced chiefly through segmentation of the hyphal cells, whereas in culture the normal mode of formation is intercalary.

The promycelia or dicaryotic hyphae derived from chlamydospores germinating on the host function as infection hyphae, penetrating two-day-old seedlings of both resistant and susceptible varieties, apparently in the main by mechanical pressure. In susceptible varieties, such as Kaifeng No. 142, the invading hyphae develop and branch rapidly within the coleoptile cells, entering the meristematic tissue as soon as four days after germination, whereas in resistant ones, e.g. Nanking No. 31, only two out of 19 seedlings under observation were found to harbour hyphae in the meristematic region.

Blackford (F. W.). **Four major diseases of Citrus.**—*Qd agric. J.*, lvii, 6, pp. 353–358, 4 figs., 1943.

The commonest disease affecting citrus in Queensland is black spot [*Phoma citricarpa*: *R.A.M.*, xx, p. 571]. All varieties may become infected, but the disease is seldom found on Washington Navel oranges and grapefruit. The next most important cause of loss of grade in citrus fruits locally is melanose [*Diaporthe citri*: loc. cit.]. All varieties may be attacked. Once the leaves and fruit are about six weeks old they become immune. Hence, as warm, showery weather and heavy dews and fogs frequently occur in Queensland coastal areas for a short period after blossoming, the disease is invariably present in these districts, though it seldom appears to any extent in the inland parts, which have a dry spring. Scab [*Sphaceloma fawcettii scabiosa*: loc. cit.] is confined to lemons and mandarin oranges, producing severe infection on rough lemon stock but rarely affecting young and well-established mandarin trees. Brown spot [*Gloeosporium* sp.: loc. cit.] occurs only in the Burrum and Elimbah areas; only one citrus variety, the Emperor of Canton mandarin, is attacked, but on this infection can be very destructive. Control of all four diseases depends on orchard sanitation, good cultural methods, irrigation, and the correct timing of the spray applications.

Irrigation Research Extension Committee Report on Citrus decline on the Murrumbidgee Irrigation Areas.—13 pp., 1943.

During the past five years the health of the citrus trees grown on the Murrumbidgee Irrigation Areas of New South Wales has seriously deteriorated. A survey in the winter of 1940 revealed that on the 6,000 acres of citrus plantings, only 53 per cent. of the trees were healthy. Of the remainder, 25 per cent. were rather unhealthy, and 22 per cent. very unhealthy. Since then, the decline has become accentuated. Wet conditions in May and June, 1942, were followed by a heavy loss of trees, and almost all the groves have now become affected, many of them seriously.

The main cause of the trouble is excessive soil moisture associated with root decay due to *Phytophthora* [*citrophthora*: *R.A.M.*, xxii, p. 133]. Other causes are soil deterioration and inadequate nitrogen. Of the various contributing factors, viz., recurring wet winters, unsuitable soil, unsuitable natural surface drainage, faulty irrigation lay-out, wrong application of water, insufficient removal of surplus water, seepage in isolated cases, and difficulties in soil management, the last five may be considered controllable.

With regard to control, growers are advised, in view of the wet winters experienced, every year to prepare adequate surface drainage early in March, and, if April irrigation is necessary, to water lightly, preferably using alternate furrows or bays. Areas where frosts are experienced should not be planted to citrus. Growers should also confine themselves as far as possible to areas with suitable soil and slope conditions [which are listed]. Experience has shown that natural slopes of over 0·4 per cent. (3 in. to the chain) are highly suitable for citrus, and those of 0·2 to 0·4 per cent. fairly so, while those of under 0·2 per cent. are unsuitable.

Irrigation should be carried out only when the soil in the maximum root zone is approaching the wilting point, and only the vertical root zone should be moistened. Allowing part of the soil to dry out by alternate area watering will assist in controlling *P. citrophthora*. Directions are given for the regulation of watering, the removal of surplus water, proper soil management and culture. For replanting, [*Poncirus*] *trifoliata*, the only stock resistant to *Phytophthora citrophthora* [ibid., xxiii, p. 105], is recommended for Valencia oranges, mandarins, and grapefruit. In conclusion, emphasis is laid on the view that the removal of excess soil moisture should be the chief aim in attacking the problem.

DUNLAP (A. A.). **Low light intensity and Cotton boll-shedding.**—*Science, N.S.*, xcviii, 2556, pp. 568–569, 1943.

Evidence obtained in recent studies at the Texas Agricultural Experiment Station indicates that abnormal shedding of cotton flower buds and immature bolls is often caused by interruption of two to three days in high sunlight intensities. For instance, upland cotton plants in jars of soil were subjected, two months after planting, to low daylight intensity (roughly equivalent to 50 ft. candles) by placing them in a laboratory room for a single four-day period. Five weeks later the plants thus treated each bore on an average only 5·4 good-sized bolls, and each had shed 30 buds and young bolls, while the corresponding figures for the controls were 21·2 bolls per plant and 17·5 fruiting forms shed. The low light intensity treatment was thus responsible for a reduction of 75 per cent. in the number of mature bolls. Similar increases in rates of shedding followed the shading of cotton plants in the greenhouse and field with black cloth, which reduced the direct sunlight intensity at midday from the equivalent of 12,000 to between 300 and 1,000 ft. candles.

BERTONI (A. DE W.). **Enemigos y enfermedades del Algodonero.** [Pests and diseases of Cotton.]—*Agric. Com. Industr., Asunción*, i, 4, pp. 57–59, 1941. [Received November, 1943.]

The most serious disease of cotton in Uruguay is anthracnose (*Glomerella gossypii*), where other pathogens of the crop include *Bacterium* [*Xanthomonas*] *malvacearum*, wilt (*Fusarium*) [?*vasinfectum*], and the leaf spots caused by *Cercospora* [?*gossypina*] and *Ramularia* [? *areola*].

WHITE (L. J.), BAKER (A. H.), & TWORT (C. C.). **Aerial disinfection.**—*Nature, Lond.*, cliii, 3874, pp. 141–142, 1944.

The authors have ascertained that cinnamic and benzoic acids are strong aerial bactericides [cf. *R.A.M.*, xix, p. 152], though citric, fumaric, maleic, malic, and phthalic acids are relatively ineffective. Maleic and phthalic anhydrides were more active than the corresponding acids. In a concentration of 4 mg. per cu. m. and a relative humidity of about 60 per cent., maleic anhydride generally sterilized the air of the test organism, *C*[*orynebacterium*] *xerosis*, in five minutes; the durability of lethal effectiveness being good, a 15-minute-old mist allowed the survival of only about 5 per cent. of the bacteria beyond the five-minute exposure time. Of 15 phenolic compounds tested, each, to sterilize or almost sterilize the air of the test organism in five minutes, required the vapour concentration to be of the order of 25 per cent. saturation. Other materials, e.g., mercuric chloride, and propylene and diethylene glycols, apparently required to be of similar concentration. Iodine and maleic anhydride were notable exceptions (below 1 per cent.).

ZOBL (K. H.). **Die Morphologie und Biologie der bei Vaginalmykosen gefundenen Sprosspilze.** [The morphology and biology of the yeasts encountered in vaginal mycoses.]—*Arch. Hyg., Berl.*, cxxx, 5–6, pp. 205–237, 6 figs., 1943.

A full description is given of the author's cultural and mycological studies at the Institute of Hygiene, University of Würzburg, on the 24 isolates of *Candida albicans*, 11 of *C. tropicalis*, 4 of *C. parapsilosis* [*C. parakrusei* fide Langeron & Guerra: *R.A.M.*, xviii, p. 253], and 1 of *Sporotrichum beurmanni* var. *asteroides* encountered in 24 cases of vaginal mycosis. Special attention was given to the taxonomy of the yeast-like fungi, the major contributions to the literature on which are critically discussed. The three *C.* spp. are relegated to the family Torulopsidaceae, subfamily Mycotoruloideae.

The solid substrata used for the culture of the fungi included beer wort, carrot, and Gorodkowa's agar and Clauberg plates, and the liquid media Raulin's, alcohol, milk, and litmus-peptone-sugar solution. The best macroscopic criterion for the

differentiation of *C. albicans* from *C. tropicalis* and *C. parakrusei* is the mode of pseudomycelial growth on solid media, which in the first-named is entirely submerged in younger cultures and seldom rises above the surface of the agar even in older ones (three to four months). The edge of the culture is therefore defined in the case of *C. albicans*, in contrast to the two other species, in which the pseudomycelium appears on the surface of the agar at an early stage. Microscopic examination of the cultures revealed an amazing diversity of forms, readily accounting for the number of descriptions of *C. albicans* as a new species. All stages of development, moreover, may be represented in each individual isolate of a given strain, from pure budding cells (the yeast growth form) to well-developed, cylindrically elongated, concatenate cells (pseudomycelia), one or another phase predominating according to the consistency and hydrogen-ion concentration of the medium, and (to a lesser extent) differences in temperature. A further complication is introduced by the occasional formation of hyphae with septation and true branching, especially where the supply of oxygen is reduced and that of carbon dioxide increased. Both on solid and liquid substrata the yeast growth form occurs principally in young cultures. The globose cells measure 3 to 6 or 8 μ in diameter, the oval 6·5 by 4, 8 by 6, or 12 by 6 μ, and the elongated 15 to 17 or 20 by 3·5 to 4·5 μ. The initially hyaline cell content later becomes strongly refringent, the enclosures staining black with osmic acid and including vacuoles, sometimes a particularly large one. Germination or budding is usually uni-, more rarely bipolar, while 'crown formation' ('Kronenbildung') may also be observed.

The pseudomycelial growth form of *C. albicans*, which was particularly prominent in alcohol and on carrot slices and carrot agar, arises from the continuous budding of a single cell, mostly in one and the same direction, the elongated cells remaining loosely united and presenting a dendriform appearance. On solid media the pseudomycelium extends deeply downwards in the shape of dense, fringed strands, simulating a rootstock. At the junction between two of the elongated cells arise the typical blastospore groups resembling blackberries, while occasional 'blastoconidia' were also observed developing laterally from the elongated cells and sometimes bearing blastospore groups at their tips. A peculiar mode of growth frequently occurs, which led to the erection by Ota of the genus *Blastodendrion* [ibid., viii, p. 677]: the few blastospores produced develop longitudinally and bear at their tips a fresh crop of 'blastoconidia'. Chains of buds, which the author considers to be reminiscent of *Catenularia* and *Scopulariopsis*, may likewise be present. As mentioned above, septate, sparsely branched true hyphae may be formed by the longitudinal extension of a bud, thereby giving rise to confusion with a Hyphomycete or the transitional genus *Trichosporum*. The large, round chlamydospores develop for the most part terminally, but may be produced on any portion of the pseudomycelium. Ascus formation was not observed.

C. albicans fermented glucose, fructose, mannose, maltose, and galactose, the last-named very weakly. Peptone, asparagin, and ammonium sulphate were utilized as sources of nitrogen. Gelatine was slowly liquefied. The fungus made equally good growth at 18°, 22°, 37°, and 45° C., apart from a slight initial delay at the last-named temperature. The thermal death point was 56° (20 minutes' exposure).

C. tropicalis is readily distinguishable from *C. albicans* on beer wort agar by its rugose surface and more or less abundant aerial pseudomycelium. The colour and consistency of the colonies are very similar to those of *C. albicans* and on most of the other substrata used the differences are not perceptible. *C. tropicalis* is also characterized by multifarious modes of growth, a single monospore culture, for instance, producing all manner of transitional stages between globose cells, 2 to 10 or 20 μ in diameter, oval to cylindrical, 5 to 12 by 3 to 4 μ, and elongated, 10 to 40 by 1 to 8 μ, the last-named sometimes being provided with transverse septa like true hyphae.

Pseudomycelium is formed most conspicuously on milk, carrots, and alcohol, particularly characteristic being the concatenate 'blastoconidia' of the *Scopulariopsis* type. Blastospore groups and occasional hyphae, as in *C. albicans*, are also produced. In contradistinction to Windisch [ibid., xx, p. 382], the author detected very few chlamydospores, and he interprets the supposed occurrence of these organs and asci in *C. albicans* and *C. tropicalis* as resting on confusion with the development of 'crowns' from old round cells.

C. tropicalis fermented glucose, fructose, mannose, maltose, saccharose, and glucose. Peptone, asparagin, and ammonium sulphate were utilized as sources of nitrogen. The temperature relations were similar to those obtaining in the case of *C. albicans*.

C. parakrusei forms on beer wort agar smooth, dully lustrous, whitish, later yellowish colonies, the periphery being surrounded by pseudomycelium, the aerial growth of which, however, is less abundant than in *C. tropicalis*. On Gorodkowa's agar the pseudomycelium develops into thick, plaited strands extending downwards into the substratum. The absence of a pellicle on alcohol serves to differentiate *C. parakrusei* from *C. krusei*.

The round, oval, and elongated cells of *C. parakrusei* measure, respectively, 2 to 4 μ in diameter, 4 to 8 by 3 to 6 μ, and 5 to 20 by 2 to 5 μ; giant round cells with a double membrane are also of frequent occurrence. 'Crown formation' was observed in a number of cultures. The well-developed pseudomycelium is predominantly of the *Mycocandida* type, as described by Langeron and Talice [ibid., xi, p. 476]. A peculiar feature is the regular arrangement of the elongated cells, giving the appearance of a monopodial branching system. 'Blastoconidia' are produced, but in smaller numbers than by *C. tropicalis*. A further differential character of *C. parakrusei* is the dimorphism due to the presence of giant cells within the pseudomycelium. Hyphal formation is occasionally simulated by the occurrence of long, filiform, budding cells. The only organs bearing any resemblance to chlamydospores were round cells with double membranes in old cultures, and the ascogenous stage failed to develop.

Glucose, fructose, mannose, maltose, and galactose were fermented to a moderate extent by *C. parakrusei*. Peptone, asparagin, ammonium sulphate, and urea were utilized as sources of nitrogen, the last-named weakly. Like *C. albicans* and *C. tropicalis*, *C. parakrusei* made equally satisfactory growth at a temperature range of 18° to 45°.

Chilton (St. J. P.), Bain (D. C.), & Person (L. H.). **Effect of seed treatments on stands of ornamental plants.**—Abs. in *Proc. La Acad. Sci.*, vii, p. 36, 1943.

Seed treatments of *Calendula*, *Salvia*, snapdragon [*Antirrhinum majus*], *Centaurea*, *Zinnia*, *Cosmos*, and pansy [*Viola tricolor*] with various commercial products recommended as increasing stands by reducing damping-off showed that the best results were given by cuprocide and yellow copper oxide, which increased the stands by 400 per cent. Vasco 4 was almost as effective as cuprocide, while spergon increased stands, but was less efficient than cuprocide or yellow copper oxide in reducing post-emergence damping-off. New improved ceresan, ceresan, and new improved semesan frequently proved toxic.

Mader (E. O.). **Effect of mineral nutrition on flower production of own-rooted Roses and the incidence of black-spot.**—*Phytopathology*, xxxiii, 12, pp. 1185–1189, 1943.

In connexion with an experiment in 1938–9 designed to determine the effect of two nutrient solutions of varying composition on flower production, 'blindness', and 'bullhead' formation (incomplete flower development) in five rose varieties, it was observed that the incidence of black spot [*Diplocarpon rosae*] was much

higher in plants grown in solution Withrow E–2, consisting of 6 per cent. potassium sulphate, 0·5 per cent. tetrahydrogen calcium phosphate, 4 per cent. each of calcium nitrate and ammonium nitrate, and 0·5 per cent. magnesium sulphate, than in Mader R–1, in which potassium sulphate was replaced by potassium nitrate and the other ingredients supplied at the rates of 2, 5·3, 8, and 4 per cent., respectively; each solution received weekly additions of 7·5 p.p.m. iron and 0·5 p.p.m. boron, 0·05 p.p.m. of copper and the same quantity of zinc, and 1 p.p.m. manganese at three-weekly intervals and was applied to the roses at a dosage of 100 gals. per 66 sq. ft. For instance, the average numbers per plant of healthy and diseased leaflets on the Briarcliff, Better Times, Johanna Hill, Ellen, and Hollywood varieties grown in Withrow E–2 were 287 and 131, 352 and 136, 293 and 193, 382 and 185, and 294 and 158, respectively, the corresponding counts for Mader R–1 being 373 and 29, 441 and 22, 354 and 53, 517 and 29, and 371 and 24, respectively.

The plants grown in the potassium sulphate solution also exhibited a different pattern from that on the potassium nitrate series, the lesions on the former being greyish, with radiating margins, giving them a feathery appearance; ultimately they turned black and assumed a roughly circular form, 1 to 2 cm. in diameter. On the other hand, the spots on the plants in the latter solution were generally minute (mere pin-points in some cases), circular, sharply defined, black, and altogether suggestive of arrested infection. The comparatively mild attack of black spot on the plants in the Mader R–1 solution was correlated with vigorous growth, luxuriant flower production, and a tendency to 'bullhead' formation.

The results of outdoor experiments in 1942, using a modified Mader R–1 solution at the rate of 100 gals. per 528 sq. ft., appeared to confirm the laboratory observations as to the efficacy of this treatment in the prevention of black spot, which infected only 157 leaves on a total of 540 plants, but further studies are necessary to differentiate between the effect of garden sites and mineral nutrition on the control of the disease.

Darke (J. E.). **Chrysanthemum cultivation.**—*Fruitgrower*, xcvi, 2496, pp. 288, 293, 1943.

Verticillium wilt is stated to be the most prevalent and devastating disease of chrysanthemums in England, where it was scarcely known, however, 30 years ago. Some 50 per cent. of all the varieties grown are affected, including some of the most popular, such as the Framfields (represented by the well-known Winter Cheer), Wallaces, Favourites, Balcombs, Precoses, and Consuls. Rust [*Puccinia chrysanthemi*] has been little in evidence of recent years, and spotted wilt has so far caused no serious damage, the Coralie variety being the only one observed by the writer to be affected. White mildew [*Oidium chrysanthemi*] is readily controllable by an occasional application of high-grade sulphur dust.

Olive (L. S.). **Thekopsora hydrangeae.**—*Mycologia*, xxxv, 6, p. 655, 1943.

In this note the author makes two minor corrections to his recent paper on *Thekopsora hydrangeae* [*R.A.M.*, xxii, p. 434].

Streets (R. B.). **Diseases of the Rose in Arizona.**—*Bull. Ariz. agric. Exp. Sta.* 190, 25 pp., 6 pl., 1943.

This bulletin provides a key for the identification of diseases of roses in Arizona and gives short descriptions with recommendations for their control. Of major importance in the State are Texas root rot (*Phymatotrichum omnivorum*), crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*), hairy root (*P.* [*Bact.*] *rhizogenes*), powdery mildew (*Sphaerotheca pannosa* var. *rosae*), to which the climbing varieties Cecile Brunner, Red Radiance, Golden Emblem, American Beauty, and Hoosier

Beauty are fairly resistant, and chlorosis, mainly due to lack of available iron. Two little studied diseases are root rot, characterized by the sudden death of the root system followed by a drying of the top, the cause of which is as yet unknown, and die-back, mainly a physiological disorder influenced by various factors lowering the vitality of the plant. Several diseases not hitherto recorded in Arizona, or only rarely, are discussed briefly, and notes are also given on [unspecified] virus diseases, of which one has been found on a few plants recently imported from another State; prompt eradication of diseased bushes is recommended as the only means of control of virus diseases.

GROVES (A. B.), MILLER (H. J.), & TAYLOR (C. F.). **Tri-state Cherry-spray investigations.**—*Bull. Pa agric. exp. Sta.* 447, 26 pp., 1943.

In this bulletin (which is also printed without change in text or authorship as Bulletin 354 of the Virginia Agricultural Station and Bulletin 310 of the West Virginia Agricultural Station), a full report is given of three years' co-operative investigations carried out in Pennsylvania, West Virginia, and Virginia to devise a satisfactory spray schedule against cherry leaf spot (*Coccomyces hiemalis*) [*R.A.M.*, xxi, p. 148].

The data obtained showed that liquid lime-sulphur failed to control late-season leaf-spot infection with subsequent defoliation, though it gave good control early in the season, when the foliage was developing rapidly, the fruit was quite tender, and the amount of inoculum small. As the fruit approached maturity, however, it became susceptible to sulphur sun scald, and this condition was aggravated by higher temperatures. When removal of the field boxes to the processing plant was delayed, the treated fruit also tended to scald. The increased danger of foliage injury after picking and the failure to control infection made the late-season use of lime-sulphur even more risky.

Bordeaux mixture gave good control both early and late in the season, but frequently reduced fruit size and increased the sugar-content relatively and absolutely. Several proprietary copper compounds gave satisfactory control, but caused fruit injury. The organic fungicides tested were, with one exception, unsatisfactory, and may have retarded fruit development. The leaves of all copper-sprayed plots showed injury, appearing as brown flecks and eventually covering most of the lower surface, accompanied by a tendency to curl upward. A characteristic stem-end or copper-ring injury developed as a black line on the fruit at the base of the stem yet separated from it by a ring of normal tissue. It was less frequent with Bordeaux than with the proprietary coppers tested.

The evidence indicated that best results are likely to follow the adoption of a split schedule. Early season applications of lime-sulphur are suggested, followed by Bordeaux mixture. One schedule tested consisted of two lime-sulphur (2 in 100 gals.) plus 3 lb. lime at petal-fall and 'shuck' stages, respectively, and two Bordeaux (2–4–100) sprays, the first Bordeaux application being made at the first cover spray (about three weeks after the 'shuck' spray) and the second as a post-harvest spray applied soon after picking. The authors consider that a similar schedule with the second Bordeaux spray shifted to pre-harvest would probably not be objectionable where the fruit is to be processed in a commercial plant, but objection would be taken to visible residue on fruit sold as fresh fruit.

SHARVELLE (E. G.) & CHEN (S. M.). **Cultural variation in single ascospore isolates of Sclerotinia fructicola (Wint.) Rehm from Cherry Plum hybrids.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1118, 1943.

Attempts to isolate complete sets of ascospores from single asci of *Sclerotinia fructicola* from cherry-plum hybrids failed until the conditions influencing the discharge of these organs were ascertained. The process was found to be stimulated

by the maintenance of the asci at 15° C. for four to ten hours, followed by transference to room temperature for two. Sixteen lines derived from two asci fell into four distinct groups on the basis of cultural characters, sensitivity to sulphur fungicides, and pathogenicity on apple fruits.

JENKINS (ANNA E.) & SHEAR (C. L.). **Gloeosporium venetum and G. necator: two distinct species.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1115, 1943.

The examination of authentic material of *Gloeosporium venetum* Speg., described from Italy in 1879, showed that the fungus is not Melanconiaceous but pycnidial in nature, while the host appears to be *Rubus fruticosus* and is in any case not *R. chamaemorus*, as originally reported. None of the Sphaeropsidaceae agrees in its entirety with *G. venetum*, though the foliicolous *Phyllosticta fuscozonata* Thuem. presents certain analogies with it. A recent study of *G. necator*, described by Ellis and Everhart in 1887 as the agent of destructive stem cankers on black and red raspberries, and supposed by Scribner (1888) to be identical with *G. venetum*, clearly showed the former to be a species of *Sphaceloma* (Melanconiaceae). The separation of *G. necator* (the perfect stage of which is *Elsinoe veneta*) from the less familiar *G. venetum* proves that the earliest records of *Rubus* anthracnose originated in North America and not, as formerly supposed, in Europe, where it was admitted by Arnaud and Mme Arnaud in 1931 to be infrequent.

GODFREY (G. H.) & YOUNG (P. A.). **Soil fumigation for plant disease control.**—*Bull. Tex. agric. Exp. Sta.* 628, 40 pp., 9 figs., 1943.

In experiments in Texas on soil fumigation against plant diseases soil was placed in containers of 2 cu. ft. capacity and various chemicals were injected at two depths, equidistant from each other and from the top and bottom. The drums were then sealed with glue-coated draft duplex paper. The covers were generally removed four days after treatment, the soil then being ventilated for two or three days. Soil samples were next put into pots in which tomato plants started in sterilized soil were then planted. When dry sclerotia of *Sclerotium rolfsii* enclosed in cheesecloth bags were introduced into the containers, the lethal dosage of ethylene dichloride was over 2,000 lb. per acre, and the same for carbon disulphide, while at 500 lb. per acre of chloropicrin one sclerotium survived in one of two treated drums. The sclerotia of the fungus were also killed by treatment of the soil with methyl bromide at the rate of $2\frac{1}{2}$ ml. per cu. ft. (400 lb. per acre). In an outdoor test beds in which a year before Dutch bulbous iris had shown approximately 50 per cent. loss from *S. rolfsii* were fumigated with chloropicrin at 500 lb. per acre by standard methods, and planted to Wedgwood iris. Only five out of 780 plants became infected, and these were all growing at the margins where the soil had been wetted for gas confinement at the time of fumigation. In a comparable non-fumigated bed 42 of 127 iris plants (33 per cent.) were killed by infection.

In experiments on the control of damping-off of tomato seedlings (chiefly *Pythium* and *Rhizoctonia* [*Corticium*] spp.) treatment was carried out on soil (25 lb.) in metal trays. The best control was given by chloropicrin (average for three years, 61 per cent. emergence and 6·6 per cent. seedlings lost from post-emergence damping-off, as against 26·6 per cent. emergence and 38 per cent. lost for the untreated controls). Carbon disulphide (one year's test) gave 51 per cent. emergence and 50 per cent. post-emergence loss. Formaldehyde gave excellent results in one year, but killed most of the seeds in the next. Semesan and cuprocide were valuable in decreasing post-emergence loss.

Taking the results of the work as a whole, the authors conclude that tomato wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*), southern blight (*S. rolfsii*), and damping-off (mainly *P.* and *C.* spp.) were generally controlled by soil fumigation with chloropicrin at rates of 2·5 to 4 ml. per cu. ft. (400 to 600 lb. per acre). Detailed

directions are given for applying the fumigation method of soil sterilization, and there is a bibliography of 74 titles.

FREAR (D. E. H.). **A catalogue of insecticides and fungicides.**—*Science*, N.S., xcviii, 2557, p. 585, 1943.

The author has compiled a catalogue of approximately 5,000 individual insecticidal and fungicidal materials mentioned in over 500 literature citations as having been submitted to test for their insecticidal or fungicidal properties. Workers are invited to communicate any unpublished data, reprints, or citations dealing with insecticidal or fungicidal tests. In particular, lists of materials tested by industrial research laboratories would be welcomed, even if the results obtained were negative. It is intended to issue the catalogue as soon as possible, and every bona fide contributor is assured of a copy.

THOMAS (C. A.). **The effect of some commercial fungicide dust fillers on plant growth.**—*Proc. La Acad. Sci.*, vii, pp. 16–17, 1943.

In tests made to ascertain the effect upon plant growth of diluents used in copper fungicides, peas and beans germinated in a filtrate containing one part bentonite clay in 50 parts water showed toxic effects, these being apparent in a brown discoloration of the roots. Peas grown directly in bentonite were stunted, and became wilted in ten days, whereas others grown in magnesia talc and pyrax were identical in size and colour with peas grown in washed sand. When magnesia talc and pyrax were applied to clover plants in the greenhouse no toxic effects followed.

YARWOOD (C. E.). **The function of lime and host leaves in the action of Bordeaux mixture.**—*Phytopathology*, xxxiii, 12, pp. 1146–1156, 4 graphs, 1943.

Sprays composed of lime alone, bluestone [copper sulphate] alone, and mixtures of both ingredients (Bordeaux) were compared for their inhibitory action on the germination of bean rust (*Uromyces phaseoli*) [*U. appendiculatus*] uredospores and cucumber downy mildew [*Pseudoperonospora cubensis*] sporangia, for the protection of Pinto beans and Long Green cucumber plants against these diseases, and for the eradication of established infections of bean powdery mildew (*Erysiphe polygoni*) at a range of dosages from below 50 to above 95 per cent. control.

To obtain 95 per cent. inhibition of germination of *U. appendiculatus* uredospores on glass, it was necessary to use 300 mg. per sq. dm. calcium oxide, 0·60 mg. copper as copper sulphate, or 64 mg. copper as Bordeaux, the corresponding amounts required for a 95 per cent. reduction in the number of rust pustules on plants being 124, 2·6, and 0·18 mg., respectively. For equivalent effectiveness it required about 100 times as much copper in the form of Bordeaux mixture as in the form of copper sulphate in tests on glass slides and about 10 times as much bluestone as Bordeaux in tests on leaves. With Bordeaux 350 times as much spray was required when the tests were on slides as when on leaves. In similar tests with *P. cubensis*, 95 per cent. reduction in germination on glass was secured by 113 mg. per sq. dm. calcium oxide, 0·049 mg. copper as copper sulphate, or 0·060 mg. copper as Bordeaux, the corresponding amounts required for equivalent protection on plants being 122, 2·2, and 1·7 mg., respectively. The addition of 0·05 per cent. phthalic glyceryl alkyd resin as a spreader decreased the quantity of fungicide required for control of *P. cubensis* to 27, 20, and 2 per cent. for lime, copper sulphate, and Bordeaux, respectively.

Bean leaves sprayed with 0·1 per cent. copper sulphate and held in a moist chamber for four hours were shown by chemical determination to retain only 43 per cent. copper on the leaf surfaces, and the control of rust was greatly reduced by exposure to such conditions, which did not, however, adversely affect Bordeaux-treated plants. The addition to copper sulphate solutions of increasing amounts of lime progressively enhanced the protective action of the mixtures against *U. appendicu-*

latus, but at the same time their value as eradicants of bean rust and powdery mildew underwent a steady decline. The optimum copper : lime ratio for the control of these diseases is probably of the order of 1 : 1. It is concluded that an important function of lime in Bordeaux mixture is to hold the copper in a form relatively unavailable and non-toxic to the plant, but toxic to pathogenic fungi.

In the light of these data it may be necessary to revise current methods for the application of *in vitro* toxicity to the evaluation of fungicides, which may be largely invalidated if many fungi are found to react similarly to *U. appendiculatus*.

HOOPER (I. R.), ANDERSON (H. W.), SKELL (P.), & CARTER (H. E.). **The identity of clavacin with patulin.**—*Science*, N.S., cxix, 2558, p. 16, 1944.

From a study of the properties of clavacin [see above, p. 168] obtained from *Aspergillus clavatus* (No. 129) the authors conclude it is identical with patulin, isolated from *Penicillium patulum* [*R.A.M.*, xxiii, p. 117 and next abstract].

FLOREY (H. W.), JENNINGS (M. A.), & PHILPOT (FLORA J.). **Claviformin from Aspergillus giganteus Wehm.**—*Nature, Lond.*, cliii, 3874, p. 139, 1944.

Aspergillus giganteus, already known to produce a penicillin-like substance, was found to produce also an antibiotic apparently identical with claviformin. The antibiotic 'patulin', isolated from culture filtrates of *Penicillium patulum* [see preceding abstract] is also known to be identical with claviformin, as is the antibiotic isolated by Wiesner from culture filtrates of *Aspergillus clavatus* [*R.A.M.*, xxi, p. 283].

STOCK (E.). **Mold (resistant paints).**—*Farbenztg*, xlii, pp. 283–285, 1942. [Abs. in *Chem. Abstr.*, xxxvii, 22, p. 6910, 1943.]

Paint moulds require water, food, a temperature of 25° to 40° C., and a hydrogen-ion concentration of $P_H 2$ to 9. The most resistant paints are those producing a hard, impervious film in the shortest drying time. Water-soluble organic binders provide nutriment for the moulds, but inorganic compounds, especially the silicates, are useful, as they dry rapidly to a hard, water-resistant, alkaline film which will not support fungal growth. A high ratio of pigment to binder is always desirable. In oil-base paints lead and zinc pigments neutralize acidity and form soaps with some fungicidal effect; zinc oxide is recommended for this purpose. The addition of organic fungicides to the coating is useful, but inorganic compounds such as mercuric chloride involve grave risks of poison. A high resin content is helpful, the phenolics being particularly valuable, while the oil-rich alkyds should be avoided. Chlorinated rubber yields an exceptionally good anti-mould film, permitting frequent scouring with chemicals. Pre-treatment of the surface to be coated to remove existing mould growths is important.

DUNNICLIFF (H. B.) & PADWICK (G. W.). **Biological examination of some Indian hide curing salts.**—*J. Indian chem. Soc.*, Industr. & News Ed., vi, 1, pp. 4–22, 1943.

A fully documented and tabulated account is given of the authors' microbiological analyses in 1942 of 26 samples of salts to determine their applicability to the curing of Indian hides. About 45 per cent. of all hides produced in India are salted, but owing to the scarcity or unavailability of inedible materials, alimentary salt is used for this purpose. In view of the increasing importance of the leather industry at the present juncture, the problem of suitable treatment of hides has become acute, and it was suggested that impure bitterns salts, i.e., the crop deposited after the purest sodium chloride has crystallized out, should be tested, primarily for their bacteriological content in connexion with the defect known as 'red heat'. A number of the samples yielded *Aspergillus* spp. in culture, but the conclusion is

reached that manufactured Sambhar Lake (Rajputana) 'bitterns' salt is serviceable for the curing and pickling of hides either for home use or export.

Resistance of textiles to micro-organisms.—*Canad. Chem. Process Ind.*, xxvii, 8, pp. 480–481, 1943.

The alternative methods of testing textiles for resistance to micro-organisms, viz., accelerated mildew infection and soil burial [*R.A.M.*, xxii, p. 396; xxiii, p. 116] here outlined are contained in Supplement No. 1 to the Schedule of Methods of Testing Textiles, issued by the Canadian Government Purchasing Standards Committee on 8th June, 1943. The accelerated mildew infection procedure is applicable chiefly to fabrics of the canvas and duck types designed for use in humid atmospheres, and soil burial to sandbags and other materials likely to be in contact with damp soil for lengthy periods. *Chaetomium globosum* is used as the test fungus in both methods.

Jensen (L. B.). **Microbiology of meats.**—xi+252 pp., 1 col. fig., 2 diags., 5 graphs, Champaign, Ill., The Garrard Press, 1942. $4.00.

Of special interest in this up-to-date, fully documented survey of available information concerning the microbiology of meat are chapters X and XI, the former dealing with the control of micro-organisms, e.g., by technical sanitation, storage in carbon dioxide, and intermittent steam sterilization, and with various methods of testing and analysis, and the latter discussing the microbiology of spices, salt, sugar, paper, and wood. In this connexion it may be noted that the mould content of some supposedly preservative spices (untreated) can be very high, especially Italian, ground black, and red peppers. Another source of pollution is the sawdust on packing, shipping, and hanging floors and the like; after three weeks the number of mould fungi in untreated sawdust on cooler floors was 819,000 per gm. compared with 50 in sawdust treated in a kiln at 180° F. for three hours and sprayed with phenyl mercuric nitrate solution (1 in 500,000).

Andersen (A. A.). **Recovery of agar from used media.**—*J. Bact.*, xlvi, 4, pp. 396–397, 1943.

Details are given of a simple and satisfactory method for the recovery of agar from used culture media developed at the Western Regional Research Laboratory, Albany, California. The sterilized medium is collected from time to time, dried, ground, washed in tap water until the soluble matter is removed, and dried ready for use. The reclaimed agar is treated with 10 gm. activated charcoal per l. before filtering when being used again.

Blackwell (Elizabeth). **Presidential address. On germinating the oospores of Phytophthora cactorum.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 93–103, 1943.

The oospores of *Phytophthora* are stated to be peculiarly resistant to germination, there being only about a dozen definite records since de Bary's in 1866. Dormant oospores of *P. cactorum*, the object of the author's special study [*R.A.M.*, xxii, p. 455], are described as colourless and transparent, perfectly spherical, and lying loosely within the colourless oogonial wall, being smallest at the height of the dormant state. The homogeneous protoplasm is enclosed within a thin, transparent outer oospore wall and a thick, transparent inner one. Within the protoplasm are lodged one excentric refringent globule, which turns brown in osmic acid and is probably of highly saturated fat, and a small and yet more highly refringent body, containing the nucleus and perhaps a plastid, which turns black in osmic acid. Oospores in which the protoplasm can no longer be discerned and appearing glassy are dead. Those preparing for germination are larger (almost filling the oogonial cavity), active, thin-walled, and the protoplasm in them is more abundant, with

the appearance of a uniform emulsion occupied by several refringent globules, among which the nucleus is not readily distinguished. As a result of much experimentation the following recommendations are made for germinating the oospores of *P. cactorum*: provided the oospores are well-formed and normal, one month or more should be allowed for full maturation at 10° to 15° C. in a moist atmosphere, followed by one to eight months of dormancy under similar conditions; the cultures are then refrigerated at a temperature just above freezing point for a week or two, soaked in tap water of P_H 8·0 and a calcium content of 19 parts in 100,000 or in a soil solution of P_H 7·0 and a calcium content of 15 in 100,000, changing the solution daily if possible. Germination occurs one to three or more weeks later, but never do all the spores germinate at the same time. The author discusses at length the nature of dormancy in oospores and the factors concerned in their germination.

Drew (J. P.) & Deasy (D.). **Losses in Potatoes during storage.**—*J. Dep. Agric. Eire*, xl, 2, pp. 306–314, 1943.

Recommendations are made for reducing losses in stored potatoes. In an investigation extending over two years evidence was obtained that careful selection of potatoes for storing is requisite to avoid losses from decay; that access of water to the pits greatly increased the loss; and that extensive sprouting took place after February, from which month potatoes should be examined at intervals and all sprouts and diseased tubers removed.

Helson (G. A. H.) & Norris (D. O.). **Transmission of Potato virus diseases. 3. Susceptibility of Cruciferae to Potato leaf roll virus.**—*J. Coun. sci. industr. Res. Aust.*, xvi, 4, pp. 261–262, 1943.

Attempts to transmit potato leaf-roll virus to a number of cruciferous plants and to the peach by means of grafting and the use of *Myzus persicae* gave negative results.

Dykstra (T. P.) & Du Buy (H. G.). **Preserving plant viruses in vitro by means of a simplified lyophile apparatus.**—*Science*, N.S., xcvi, 2486, pp. 189–190, 1 diag., 1942.

A method is described for preserving the longevity of plant virus preparations by the use of a modified lyophile apparatus, in which the plant juice containing virus is dehydrated by a combination of evacuation, condensation, and chemical drying. The two viruses used were potato virus Y and that of Canada streak [potato aucuba mosaic virus], which when extracted in air remain viable at 15° C. for about 72 and 120 hours, respectively. In the present study the two viruses were extracted in carbon dioxide and, after being dehydrated in the lyophile apparatus, continued to produce 100 per cent. infection for as long as four months.

Rieman (G. H.) & McFarlane (J. S.). **The resistance of the Sebago variety to yellow dwarf.**—*Amer. Potato J.*, xx, 10, pp. 277–283, 1943.

In field tests conducted in 1941 and 1942 on 19 farms in the yellow dwarf [*R.A.M.*, xxii, p. 399] potato area of central Wisconsin, representing a wide range of growing conditions, only 0·5 per cent. of plants of the variety Sebago on all farms became infected, whereas approximately 18 per cent. of those of the variety Russet Rural were diseased. The results clearly indicated that the variety Sebago, though apparently very resistant to yellow dwarf, is not immune, showing 0 to 2 per cent. (average 0·5 per cent.) infection. The symptoms on the infected Sebago plants were as distinctive as on Russet Rural, indicating that once infection occurs, the progress and behaviour of the disease is comparable in both varieties. It is suggested that the low incidence of yellow dwarf in the Sebago variety may be due to the avoidance of that variety by the vectors. High agreement was found to

exist between yellow dwarf expression in the field and in the greenhouse. It is considered that by carefully controlling temperature relationships, more consistent results may be expected in the greenhouse than in the field.

The F_1 population of a cross between Sebago and the susceptible variety Hindenburg showed 7 per cent. yellow dwarf as compared with 40 per cent. in the variety Russet Rural, indicating that yellow dwarf resistance may possibly be inherited.

Köhler (E.). **Untersuchungen über das K-Virus der Kartoffel. 2 Mittlg.** [Studies on the K-virus of the Potato. Note 2.]—*Angew. Bot.*, xxv, 1–2, pp. 13–23, 6 figs., 1943.

Continuing his studies on the K-virus of the potato [*R.A.M.*, xxi, p. 500], the writer carried out a series of experiments on the transmission of the disease by means of viruliferous aphids (*Myzus persicae*), which were applied to halved tubers of the Jubel, Stärkereiche [Starchy], and Juli varieties before planting them in pots, the inoculum being derived from a second-year Altgold plant. Six out of ten Jubel plants arising from the inoculated tubers showed uniform symptoms, consisting of a more or less pronounced crinkle mosaic of the apical leaves, accompanied by a necrotic stippling, and in some cases by necrotic streaks on the stem. Samsun tobacco plants, inoculated with juice from the diseased Jubel potatoes, contracted the symptoms associated with the X-virus, thereby confirming previous observations as to the latency of the latter in this variety. In the following year (1942) the progeny of all the Jubel plants which had shown unmistakable symptoms of infection by the K-virus developed the typical features of a powerful X+A infection. In the case of Starchy no symptoms became apparent during the year of inoculation, but the progeny of five out of ten plants developed mild mosaic, and a sixth showed the typical severe symptoms; the latter was the only one, as shown by juice transmission tests on Samsun, to contain the X-virus, the combination of which with K induces a well-marked mosaic of tobacco leaves. The inoculated plants of the Juli variety and their offspring exhibited complete immunity from infection.

Another series of aphid transmission tests was conducted to establish the assumption, based on the results of previous investigations, that the leaf-rolling mosaic of the small-leaved Wohltmann variety is caused by virus K. Out of one lot of 15 plants, at least seven yielded definite evidence of transmission, while another two developed an unfamiliar type of infection, termed '*aurea*', details of which are reserved for publication elsewhere. In a second batch of 15 plants only three reacted positively; in two of these the symptoms were aberrant, and in the third leaf roll was already present, resulting in a mixture of symptoms.

Of 15 young plants—five each of Jubel, Parnassia, and Wohltmann—inoculated by rubbing the leaves with K-virus juice from Ackersegen, only two of the last-named variety responded positively. The virus was similarly transmitted to *Solanum ajuscoense, S. antipoviczii,* and *S. demissum* and its var. *xitlense. S. demissum* would appear to be particularly well adapted for experimental purposes.

Allen (L. A.). **Spore-forming bacteria causing soft rot of Potato and retting of Flax.**—*Nature, Lond.*, cliii, 3877, pp. 224–225, 1944.

Samples of retting liquor and flax taken at various stages during different processes of retting were submitted to bacteriological examination, and it was ascertained that at or near the completion of the retting soft rot of potato was consistently produced by high dilutions of the liquor or of the flax extract. Bacteria causing soft rot of turnip were also consistently present.

The evidence showed that ability to cause potato soft rot was restricted to spore-bearing bacteria. Anaerobic spore-bearers usually predominated among the causal organisms, but aerobic spore-bearers were sometimes present in appreciable numbers. From two different rets *B[acillus] subtilis* was isolated in pure culture.

From each strain an enzyme powder was prepared, capable of acting in the presence of an antiseptic inhibiting bacterial growth. These enzymes were found to rot potato and ret flax. The fact that retting in tanks on a large scale is accompanied by the growth of large numbers of spore-forming bacteria which produce potato soft rot suggests that they may also be responsible for the retting.

Hoffmaster (D. E.), McLaughlin (J. H.), Ray (W. W.), & Chester (K. S.). **The problem of dry rot caused by Macrophomina phaseoli (= Sclerotium bataticola).**—Abs. in *Phytopathology*, xxxiii, 12, pp. 1113–1114, 1943.

'Charcoal rot' (*Macrophomina phaseoli*) of maize [*R.A.M.*, xxii, p. 384], sorghum, potatoes, beans, cowpeas, and groundnuts is a major pathological and economic problem in the southern United States, where the losses may amount to 48 per cent. in maize and 5 to 75 per cent. in potatoes. New hosts of the pathogen are *Catalpa*, cedar, lucerne, and broom corn [sorghum]. The fungus is chiefly injurious to seedlings and immature plants devitalized by environmental extremes, wounds, or infection by other organisms, its effects including damping-off, stem rot, precocious ripening, low yields, and premature death. *M. phaseoli* flourishes at high temperatures. Single conidia invariably produce the sclerotial stage of the fungus, and it is suggested that the sclerotia may be immature pycnidia. Tentative proposals for control, based on the improvement of crop health and vigour through cultural practices, include the liming of soil (for sorghum), increasing the organic content of the soil, and the use of resistant varieties.

Watson (R. D.). **Charcoal rot of Irish Potatoes.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1120, 1943.

Tuber rot of potatoes (*Sclerotium bataticola*) [*Macrophomina phaseoli*: see preceding abstract] was very severe in eastern Texas in 1943, causing losses of 15 to 20 or up to over 50 per cent. of the crop in the ground or in storage. The fungus frequently enters the tuber through the stolon end, while the eyes and enlarged lenticels also serve as channels of infection. The embedded sclerotia impart an ashen-grey tinge to the stolon, while diseased tubers develop a somewhat flaccid, watery, usually superficial, black rot. Secondary infections, e.g., by *Erwinia carotovora* and *Fusarium* sp., are of common occurrence, but in their occasional absence the tubers invaded by *M. phaseoli* eventually acquire a leathery consistency and undergo mummification. The chief factors in an epiphytotic are high temperatures and high soil moisture.

Harvey (R. B.) & Lee (S. B.). **Flagellates of lactiferous plants.**—*Plant Physiol.*, xviii, 4, pp. 632–655, 14 figs., 1943.

At the United States Plant Introduction Garden, Coconut Grove, Florida, in the vicinity, and on the Keys, flagellates [*R.A.M.*, iv, p. 701] were found in 12 new species of plants. Flagellates have previously been reported in the families Euphorbiaceae (28 species), Asclepiadaceae (5), Apocynaceae (5), Sapotaceae (1), Urticaceae (3), and Compositae (1). Of the commercial rubber-producing plants flagellates have been found in *Cryptostegia grandiflora*, *Funtumia elastica*, and *Taraxacum kok-saghyz*. Hundreds of specimens from other genera of laticiferous plants did not show the presence of flagellates.

Infected plants growing in their natural habitat showed no apparent symptoms of disease, the presence of the organisms being detected only by microscopic examination. Watery latex was not a criterion of infection, for flagellates were found in very viscous, creamy latex of *Funastrum clausum* growing in a dry soil. *Chamaesyce conferta* growing in cracks of bituminous pavement showed general infestation in dry weather, though after a heavy rain flagellates were found with difficulty. *C. hypericifolia* growing in coral rock in full sunlight showed high in-

festation, while large, vigorous plants growing in shade on moist glade land immediately adjacent showed no flagellates. *Poinsettia heterophylla* showed infestation of one branch tip of a plant 8 ft. high, but no flagellates in latex from another branch. The flagellates often disappear from the latex of petioles of leaves and from the peduncles of flower clusters. After some hours' rain a potted plant of *P. cyathophora*, which previously had shown many flagellates, failed to show them in any petiolar latex, though they remained in a plant whose leaves had been protected from the rain.

Latex flagellates are difficult to culture, but mass multiplication was obtained in a rich, beef-extract peptone medium injected into coco-nuts containing their natural milk and in the same medium in flasks to which fresh *Hevea* latex was added. The flagellates in *Poinsettia*, *Chamaesyce*, and *Funastrum* have a single anterior flagellum, which arises anterior to the parabasal body. In *F.*, the flagellum is very short. In *P.* and *C.* the flagella are often longer than the body. The blepharoplast and nucleus differ in the different host species in size, position, and staining density. Some nuclei are large, rounded, and distinct, while others are elongated and indistinct. In *F.* only thin, twisted, ribbon-like forms with blunt-ended bodies were seen. These same forms occurred in the other latices, but were less usual in *P.*

WHITE (N. H.). **A spot disease of Guayule (Parthenium argentatum Gray).**—*J. Coun. sci. industr. Res. Aust.*, xvi, 4, pp. 258–260, 2 pl. (facing p. 300), 1 fig., 1943.

In November, 1942, imported guayule (*Parthenium argentatum*) seed was planted in a half-acre, well-protected plot at Canberra. Early in March, 1943, leaf-spot symptoms developed on a few plants, and from then until May the disease spread on individual plants and to those surrounding the originally infected ones, until about 20 per cent. of the area was affected. The diseased plants occurred in patches extending to about 20 ft. in diameter. The same condition was also observed in flats at Black Mountain.

The first symptom was the appearance of concentrically disposed, sunken, light brown points covering a circular area about 3 to 8 mm. in diameter, and surrounding a rather larger, darker, central lesion. The spots were spaced at intervals of about ½ mm. Gradually the whole affected area became brown and dead; occasionally the entire leaf became involved, with resultant defoliation. The zone of defoliation extended from near ground-level to one-third of the height of the plant. Above this, the lowest leaves were black, dry, and dead, those higher up showing a few spots or none. Some plants were killed, and most remained stunted. Blackish lesions were also noted on flower stalks, mainly near the foliage. Inoculations of healthy plants with conidia from lesions gave characteristic symptoms.

The fungus was identified as a species of *Ramularia* somewhat resembling *R. bellunensis* [*R.A.M.*, xvii, p. 584]. The sporodochia-like fruit body consists of fasciculate, septate, hyaline, branched or simple conidiophores, 90 to 200 μ long, bearing chains of hyaline, cylindrical, usually uniseptate conidia, 20 to 44 by 2·1 to 5·2 (average 36·5 by 3) μ.

Two lots of seed soaked in water for 24 hours, then immersed for two hours in a 5 per cent. solution of calcium hypochlorite, washed in running water for 12 hours, and finally dried and sown, gave plants free from disease, though seed of the same lots, untreated or rubbed out only, produced diseased plants.

MARTIN (T. L.) & ANDERSON (D. A.). **Organic matter decomposition, mold flora and soil aggregation relationships.**—*Proc. Soil Sci. Soc. Amer.*, vii, pp. 215–217, 1942. [Abs. in *Chem. Abstr.*, xxxvii, 20, p. 6076, 1943.]

The changes in chemical composition accompanying the decomposition of organic

matter in the soil induce corresponding alterations in the mould population. The fungi developing during the process of disorganization differ in their capacity for the aggregation of soil particles, the order of efficiency in this respect being related to the chronology of their appearance and increasing from *Rhizopus* through *Mucor*, *Penicillium*, and *Aspergillus* to *Cladosporium* [*R.A.M.*, xxii, p. 274].

PAPE (H.). **Die Herzfäule des Mohns. Eine für Deutschland neue Ölmohnkrankheit.** [Poppy heart rot. An Opium Poppy disease new to Germany.]—*Kranke Pflanze*, xx, 7–8, pp. 63–64, 6 figs., 1943.

Heart rot of the opium poppy (*Papaver somniferum*), associated with boron deficiency, has of late been observed to cause severe damage to the crop in various parts of Germany [*R.A.M.*, xxi, p. 471], where its cultivation, like that of other oil-yielding plants, is being widely extended. In the 26 stands inspected by the writer in the Kiel district the incidence of the disease mostly ranged from 10 to 20 per cent., with a minimum of 1 or 2 and a maximum of 85, while losses of 20 to 30 per cent., were not uncommon. The reaction of the soils on which the affected plants were growing was slightly acid to neutral (P_H 5·8 to 7·1). Symptoms of the disturbance, which presents a close analogy with heart rot of beet and is presumably controllable by similar measures, include stunting (often down to half the normal height); a dark purplish-brown discoloration and dying-off of the heart; distortion and crinkling of the leaves, accompanied by a partial yellowish-grey tinge and blackening of the veins; dark spots and stripes, sometimes also blisters and cracks, on the stems, whence a brownish-black latex is exuded, and in most cases, a more or less extensive blackening and disorganization of the internal stem tissues.

DRUMMOND-GONÇALVES (R.). **Ferrugem da Hortelã Pimenta.** [Mint rust.]—*Biológico*, ix, 12, pp. 383–386, 1 fig., 1943.

Mint rust (*Puccinia menthae*) has recently been observed in various districts of the State of São Paulo, this being the first authenticated report of the pathogen for Brazil. The uredospores retain their germinability for over 180 days, and under the mild winter conditions prevailing locally the rust will probably be perpetuated by means of these organs. On the other hand, the optimum temperature for uredospore development lies between 15° and 25° C., so that the diffusion of the disease is likely to be restricted during the rainy months, at which time, moreover, the resistance of the host to parasitic infection reaches a maximum. Another factor that may limit the activities of *P. menthae* in São Paulo is the prevalence of *Darluca filum* [*R.A.M.*, xxii, p. 264]. Control measures should include the annual renewal of plantings, ten minutes' immersion of the rhizomes in water heated to 45° C. before planting in furrows at least 5 cm. in depth; in cases of severe infection, the leaves should be harvested early and cut right down to the ground, a second cutting being made before the advent of the cold weather to prevent teleutospore development; after gathering the crop, all refuse should be buried or burnt to check the spread of the rust.

CROSS (W. E.). **Datos adicionales sobre el 'carbón' en las distintas variedades de la Caña de Azúcar.** [Additional data on 'smut' in the different Sugar-Cane varieties.]—*Bol. Estac. exp. agríc. Tucumán* 43, 13 pp., 1943.

Further data are presented concerning sugar-cane smut [*Ustilago scitaminea*] in Tucumán, Argentine, during the season of 1942–3 (up to 25th November) [*R.A.M.*, xxiii, p. 150 and next abstracts]. Infection proceeded uniformly up to the second half of December, reaching a climax in the first week of January and continuing with diminished intensity until the middle of May, when the final count was made. The following varieties remained free from smut throughout the year: P.O.J. 2725, 2727, and 2961, and Tuc. 1149, 1238, 1296, 1590, 2605, 2611, 2613,

2622, 2645, 2651, 2657, 2680, 2683, 2701, 2704, and 2705. Slight sporadic infection occurred on Co. 290 and Tuc. 379, 1111, 1190, 1220, 1406, and 2634, while Co. 270, Kavangire, P.O.J. 2878, and Tuc. 630 sustained a somewhat heavier, but still very mild attack. On the susceptible varieties P.O.J. 36 and 213 and Tuc. 472 and 1376 the disease assumed a much more severe form than in 1941–2. Besides the varieties already enumerated, the following contracted virulent infection at the Experiment Station: Paz Posse (P.O.J. 36 purple), P.O.J. 36M, P.O.J. 36 striped, P.O.J. 161 and 234, P.W.D. 38, and Tuc. 385. Symptoms ranging from moderate to severe were observed on Tuc. 355, 362, 399, 1106, 1176, 1180, and 1331, an intermediate degree of infection was registered on Co. 508, C.P. 28/11, 28/19, 29/320, P.O.J. 1337 and 2696, Uba of Puerto Rico, and 49 Tuc. lines. Bambú de Tabandí, Co. 281, 284, and 289, C.P. 807, Oshima, P.O.J. 1507, Yon Tan San, and 24 Tuc. lines were apparently resistant, while virtual immunity was exhibited by Co. 413 and 421, C.P. 29/116, P.O.J. 2714, 2725, 2727, 2883, 2946, 2947, 'P.O.J. 2961', S.P.I. 33.243, Uba Brandes, and 240 Tuc. lines.

Studies on the heredity of the Tucumán lines showed that all descendants of Nos. 11, 27, 33, and 37 have hitherto remained entirely free from smut, while the offspring of 10, 14, 15, 22, 23, and 28 are highly resistant, whereas the progeny of 7, 8, 29, 30, 31, 32, and 34 are subject to a considerable degree of infection.

Hayward (K. J.). **El 'carbón' de la Caña y los insectos.** [Sugar-cane smut and insects.]—*Circ. Estac. agríc. Tucumán* 123, 1 p., 1943.

Three species of insects are constantly found associated with sugar-cane smut (*Ustilago scitaminea*) [see preceding abstract] viz., a species of *Phalacrus* (Phalacridae), *Brachytarsus zeae* (Anthribidiae), and *Anthicus albifasciatus* (Anthicidae). Though these insects may benefit the host by consuming smut spores, they are likely to assist in the dissemination of smut from plant to plant by the spores which adhere to their bodies. However, the risk of spread by insects is negligible in comparison with the effect of wind in plantations where the destruction of diseased material is omitted.

Lucas (G. B.). **Further studies on the deterioration of the red rot fungus in culture.** (Abstract).—*Proc. La Acad. Sci.*, vii, p. 35, 1943.

Continuing his earlier investigations [*R.A.M.*, xxi, p. 303], the author carried *Colletotrichum falcatum*, the agent of sugar-cane red rot, through 37 single-spore and 39 hyphal-tip generations on oatmeal agar with no loss of sporulation. When the cultures were allowed to age, light-coloured patch variants appeared, which on subsequent culturing produced only a few spores. Loss of sporulation by *C. falcatum* would appear to be due to the occurrence of patch variants, which tend to replace the original type and produce few or no spores.

Hirschhorn (Elisa). **Adiciones y correciones a los especies del genero 'Ustilago' en la Argentina.** [Additions and corrections to the species of the genus '*Ustilago*' in Argentina.]—*An. Soc. cient. argent.*, cxxxiii, 3, pp. 217–218, 1942.

In this summary of the results of the author's study of material collected since the publication of her previous contribution to the knowledge of the Ustilaginales of Argentina [*R.A.M.*, xviii, p. 710], it is stated, *inter alia*, that *Ustilago paspali* Speg. is separated from *U. microspora* Schroet.; and that the diagnoses of a number of species, among them *U. paraguariensis* [on *Cynodon dactylon*: ibid., xix, p. 120], are completed. In a planting of oats at Neuquén consisting of a mixture of *Avena sativa* and *A. nigra*, some 25 per cent. of the former were attacked by *U. levis* [*U. kolleri*], from which the latter at the time of writing was still free, suggesting the possibility of its utilization in the development of immune varieties by hybridization.

Teixeira de Vasconcelos (A.). **Fusarioses.**—*Rev. agron., Lisboa*, xxx, 1, pp. 19–48, 1 diag., 1942. [Portuguese.]

This is a survey of the available information on the genus *Fusarium*, among the aspects discussed being its taxonomy, economic significance, parasitism, toxicity to livestock, modes of infection, response to environmental factors, conditions predisposing and adverse to the development of fusarioses, host resistance, and measures of indirect and direct control.

Coker (W. C.) & Beers (A. H.). **The Boletaceae of North Carolina.**—viii+96 pp., 66 pl. (6 col.), 7 figs., Chapel Hill, University of North Carolina Press, 1943. $7.00.

In this work the authors describe 68 species and six varieties of *Boletus*, including three new species and four new varieties, together with four species of *Boletinus* and one of *Strobilomyces*. Twenty species are represented in colour, and almost all the remainder in half-tone photographs. There are, in addition, five plates of line drawings of spores. The study includes a description of the genus *Boletus*, with keys to the species. There is a two-page bibliography.

Preston (N. C.). **Observations on the genus Myrothecium Tode. I. The three classic species.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 158–168, 2 pl., 5 figs., 2 graphs, 1943.

The author gives emended descriptions of the genus *Myrothecium* and its three classical species, *M. roridum, M. verrucaria*, and *M. inundatum*, based on a study of exsiccata and living material. *M. roridum* forms sessile, discoid, often confluent sporodochia, 0·1 to 1·5 mm. in diameter, green at first, becoming black, white-rimmed, without setae, arising from the mycelium or erumpent stroma, with a woolly margin; hyaline conidiophores once or twice branched, the main axis tapering, of three or four cells, the basal, 30 by 3 μ, and the apical, 10 by 1·5 μ, the branches uni- or bicellular, each terminating in a whorl of usually 3 to 7 phialides, which are slenderly clavate, straight, hyaline, sometimes arising below the septum of an intermediate cell forming a closely packed hymenium-like layer; and cylindrical or slightly tapering conidia with rounded ends, continuous, hyaline, becoming pale green, 5 to 9 by 1 to 2·5 μ, the spore mass being green, then jet-black and viscid.

In Britain *M. roridum* has been isolated from three hosts only, *Viola tricolor* [*R.A.M.*, xviii, p. 802], *Antirrhinum majus* [ibid., xvii, p. 590], and tomato. When cultured on various artificial media the three isolates were indistinguishable from one another, except that the fungus from *V. tricolor* usually stained maize-meal agar bright yellow. The following cultures received from the Imperial Mycological Institute are considered to be referable to *M. roridum*: one from *Hibiscus esculentus*, two from *Dolichos lablab*, and one from *Trichosanthes*, all collected by Deighton in Sierra Leone [ibid., xviii, p. 157]. Both the British and African specimens showed a very similar response to temperature: the optimum was at about 30° C., but all grew almost equally well at 20°, the African forms growing slightly more rapidly at either of these temperatures; growth was inhibited in all at 37°, but whereas the African forms remained viable for four days at this temperature and resumed growth when transferred to 23°, the British made no recovery under similar circumstances. The effect of hydrogen-ion concentration of the medium on the growth of the species was studied only on the British isolates from *V. tricolor*, which were definitely favoured by alkalinity: no growth occurred at P_H 3·4, but at P_H 4·8 the fungus grew normally, the rate of growth increasing slightly with rise of P_H from this point to a maximum of 8·2.

Stevenson (J. A.). **Fungi novi denominati. I.**—*Mycologia*, xxxv, 6, pp. 629–637, 1943.

Technical descriptions with Latin diagnoses are given of 12 hitherto undescribed

fungi, including *Clasterosporium polypodii* n.sp. on *Polypodium nanum* from Venezuela.

Fifty-fifth Annual Report of the Kentucky Agricultural Experiment Station for the year 1942.—51 pp., [1943].

In this report on plant disease work in Kentucky in 1942 [cf. *R.A.M.*, xxi, p. 516], it is stated that *B[acterium] angulatum* [*Pseudomonas angulata*] was isolated from artificially inoculated soil and naturally infected field soil throughout the winter to 21st April [ibid., xxi, p. 308]. Where cover crops were growing in artificially inoculated soil, more bacteria were isolated than from fallow soil. Roots of wheat, crimson clover [*Trifolium incarnatum*], and vetch, grown outdoors in artificially contaminated soil, carried the organism. Cover-crop roots (wheat, barley, and rye), collected during the spring of 1942 from fields where tobacco had been infected with *P. angulata* and wildfire [*P. tabacum*] in 1941, produced severe infection on tobacco leaves when the roots were washed, crushed in water, and poured over the under surface of water-soaked leaves. Tests with tobacco-bed soils while the plants were small gave no infection, but as the plants became larger *P. tabacum* was isolated from the roots of plants in five beds, *P. angulata* from those in 19, both from those in one bed, and neither from those in 22 beds. Both were obtained from shepherd's purse [*Capsella bursa-pastoris*] and quack grass [*Agropyron repens*], *P. tabacum* alone from knotweed [*Centaurea* sp.], henbit [*Lamium amplexicaule*], and quack grass, and *P. angulata* from ragweed [*Ambrosia* sp.] and various grass and weed roots. Bacterial colonies were easily found on the roots of tobacco plants from beds and from fields affected by wildfire and angular leaf spot. Heavy infection developed on tobacco leaves when the inoculum consisted of a fragment of root tissue on which the colony was present. Both diseases were repeatedly produced on inoculated leaves throughout the summer and autumn in this way, indicating that in the field tobacco roots may be the source of inoculum for sudden outbreaks in wet periods. Heavy infection of water-soaked tobacco leaves resulted from inoculated roots of wheat, oats, barley, rye, castor beans [*Ricinus communis*], soy-beans, cowpeas, vetch, lucerne, red clover [*T. pratense*], crimson clover, *Plantago*, and *Oxalis*.

The Burley tobacco variety Ky 52, obtained by back-crossing mosaic-resistant (N) *Nicotiana digluta* Burley hybrids with Ambalema type mosaic-resistant Burley has remained free from mosaic [ibid., xxii, p. 499; xxiii, p. 152] for three years, even when inoculated. It also makes rapid, vigorous growth in soil infected with black root rot [*Thielaviopsis basicola*]. It merits trial by growers.

As the N type of mosaic resistance in Ky 48—7 Burley tobacco has been criticized because inoculated plants sometimes develop systemic streak and die, a test was conducted, in which one bed of N plants was heavily inoculated with mosaic and another lightly inoculated about a week before pulling and setting. Leaf-spotting appeared in both beds, but no streak. In the first three weeks after setting 12·6 and 5·2 per cent., respectively, of the plants set from these beds died. When other plants were pulled with hands contaminated with dark, fire-cured tobacco from mosaic plants, all 91 plants set remained healthy, but when healthy plants were pulled with hands contaminated with inoculum from freshly crushed mosaic leaves, only 4 of 94 plants set remained alive three weeks after setting. The usual contamination on workers' hands while weeding or pulling can have very little effect on the stand of resistant plants, and handling even severely necrotic plants at pulling time cannot have much effect on stand. In the mosaic breeding plot, where all plants were inoculated with mosaic and were subject to reinfection throughout the summer, only two of several hundred N plants developed streak. Several years' work with N-resistant plants has furnished no evidence that this type of resistance would not control tobacco mosaic.

Beach (W. S.) & Sacco (P.). **Pathogenicity for Tobacco of some bacterial isolates antigenically similar to Bacterium tabacum.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1109, 1943.

The comparative pathogenicity to Pennsylvania Broad leaf tobacco of 62 cultures of bacteria selected from a series of 603, isolated by Reid *et al.* from healthy clover and tobacco and tobacco soils [*R.A.M.*, xxii, p. 80], was determined at the Pennsylvania Agricultural Experiment Station. Following heavy atomization of succulent leaves, 36 isolates, comprising some from each of the above-mentioned sources, induced the development of wildfire spots comparable to those associated with *Bacterium tabacum* [*Pseudomonas tabacum*], while the remainder gave negative results, except for a few which were capable of slight penetration of tissues subjected to water-soaking by a forced spray, and may have been strains of *Bact. angulatum* [*P. angulata*] of a low order of virulence. Weak isolates of *P. tabacum* acquired a marked enhancement of pathogenicity by seven daily passages through either of two liquid media, one consisting of mineral salts and 5 per cent. asparagin, and the other of unheated tobacco juice and 2·5 per cent. asparagin. The non-infectious isolates acquired no appreciable pathogenicity by passage through these media. The increased virulence appeared to be due to the abundance of halo-producing toxin. The harmless character of a large proportion of the wildfire isolates affords further evidence that similar agglutination reactions [loc. cit.] are not necessarily correlated with equality of virulence. Field observations as to the overwintering of *P. tabacum* in Pennsylvanian soil appear to be confirmed by these experiments.

Ware (W. M.) & Glasscock (H. H.). **Bacterial canker of Tomato.**—*J. Minist. Agric.*, l, 11, pp. 499–503, 2 pl., 1 map, 1944.

During May and June, 1942, tomatoes grown in two commercial glasshouses in East Sussex were found to be affected by bacterial canker (*Corynebacterium michiganense*) [*R.A.M.*, xxiii, p. 155]. In July, 1943, outdoor tomatoes in West Sussex were observed to show marked infection. A few days later another specimen was received from a second nursery in West Sussex, followed soon after by others from Surrey and East Sussex, and by early September the disease appeared to be present in seven plantations. The worst outbreaks occurred in two Surrey plantations. In one nursery more than one quarter of a plantation of 8,000 outdoor tomato plants was severely affected; over 1,000 of these had been dug up and destroyed by mid-August. Fruit-spotting early in September further reduced the saleable crop. In another nursery in the vicinity about 20 per cent. of the plants in a half-acre plantation showed severe symptoms in mid-August, and the disease appeared to be spreading. Severe infection was also present in two other Surrey plantations, though only two or three plants were reported as being affected in the West Sussex plantations.

In four Surrey nurseries the Hundredfold variety was affected first and also most severely. The seedlings used by three of the nurseries had been raised in a single glasshouse, and the seed to produce these had been obtained from the same firm of seedsmen as the seed used by the fourth nursery. This seed was of Canadian origin, and may possibly have been infected. In the Sussex outbreaks the seed came from different sources, all, apparently, in Britain. The channels through which the disease was introduced have not been discovered. Trials of American varieties have, however, been made in the last few years in different places in the south of England, and infection may have arisen from these sources.

The first precaution to take in prevention is to use seed only from areas where infection has not occurred. Seed should not be saved from houses or plants in which infected plants have appeared. If trials are conducted with foreign seed, the seedlings should be raised in houses separate from those used for raising seedlings for the commercial crop. Soil in glasshouses should be steam-sterilized.

The Ministry of Agriculture has taken action under the Destructive Insects and Pests Acts requiring growers on whose premises the disease has occurred to destroy infected material, not to save seed from infected crops, and to take various other precautions. Growers who suspect the presence of the disease should report the matter at once.

MOORE (W. D.) & THOMAS (H. R.). **Some cultural practices that influence the development of Alternaria solani on Tomato seedlings.**—*Phytopathology*, xxxiii, 12, pp. 1176–1184, 1 graph, 1943.

In the course of further studies on the factors affecting the incidence of *Alternaria solani* on Marglobe seedlings in Georgia [*R.A.M.*, xxii, p. 157] and Indiana, the amount of infection was found to increase with the age of the plants, the extension of wilting periods (between picking and packing for export) from 6 to 24 hours, and the prolongation of storage at the northern destination of the seedlings up to four days before planting out. An appreciable reduction in the extent of loss or damage from the leaf blight may be effected by the avoidance of these errors.

GOTTLIEB (D.). **Expressed sap of Tomato plants in relation to wilt resistance.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1111, 1943.

Sap expressed from the stems of three tomato varieties retarded the growth of *Fusarium bulbigenum* var. *lycopersici* [*R.A.M.*, xxii, p. 330] in proportion to their individual resistance to the fungus, the average yields of the mycelial mats in sterile extracts from Bonny Best, Marglobe, and Pan American being 0·145, 0·110, and 0·065 gm., respectively. Comparable results were obtained when the saps were mixed with equal parts of 3 per cent. potato dextrose agar and the linear growth measured, the average dimensions of the colonies on media from the three varieties being 81, 74, and 65 mm., respectively. The inhibitory substance in the juice was stable at 100° C. for two hours, and was absorbed by activated charcoal at room temperature. Its repressive properties survived distillation at 95° under reduced pressure.

CHESTER (K. S.). **Physiogenic brooming in Chinese Elm.**—*Proc. Okla. Acad. Sci.*, xxiii, pp. 46–49, 1 fig., 1943.

The writer's investigations in 1942 on the etiology of a brooming disease in a 320-acre block of Chinese elms (*Ulmus pumila*) near Oklahoma City are described. The branches of the trees, which were obtained 12 years previously from a Texas nursery, bore hemispherical galls, 1 to 3 cm. in diameter, their surfaces roughened by many adventitious buds, and each producing 3 to 12 adventitious twigs, nearly half of the latter being dead. The internal tissues of the excrescences, which consisted entirely of hypertrophied phloem and cortex, were distorted but not decayed. The galls occurred exclusively at the nodes, the condition being evidently systemic, since every node on each affected branch was involved. The exudation of mucilage from the outgrowths was observed. On an inspection of the growing trees from which the galls had been removed for laboratory studies, the most conspicuous feature was found to be the production by the shortened main branches of five or six times the normal number of small lateral branches, occasioned by a die-back of the terminal twigs during the previous five years.

In view of the facts that no pathogenic organism could be demonstrated, the condition was not graft-transmissible, no evidence of spread from broomed to healthy trees was apparent, and the former recovered a year or two after transplanting to more favourable sites, the Chinese elm disease is considered to be non-contagious and of physiogenic origin. Among the contributory factors may have been the inability of the roots to penetrate the impermeable clay subsoil of the block sufficiently to develop the extensive root system required to withstand the

effects of drought, which occurred in a severe form from 1934 to 1936; defoliation by leaf-feeding insects in 1940–1; a destructive ice storm in the winter of 1939 to 1940; and an exceptionally hard frost in November, 1940, resulting in widespread injury to tree trunks throughout the south-west.

GRUENHAGEN (R. H.). **Life history of Hypoxylon pruinatum in relation to pathogenicity on Aspen.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1112, 1943.

Aspen stands inspected in the Lake States, where the tree is widely used for boxwood, pulpwood, and the like, and constitutes a potential source of raw cellulose for explosives and plastics, harboured 10 to 60 per cent. infection by *Hypoxylon pruinatum* [*R.A.M.*, xix, p. 505], which was found to enter exclusively through bark wounds. Inoculation tests were most successful when the fungus was inserted through an injury near the centre of a bruise. An active infection girdled a 4-in. tree in two to three years and spread 3 to 6 ft. in a vertical direction. The pathogen invaded only the cortex, cambium, and outer wood. Conidia were borne on conidiophores at the surface of the canker, as well as on raised mycelial pillar-like structures, and were abundant during the spring and early summer. From April to the end of September ascospores were forcibly expelled from perithecia in stromata protruding above the canker surface. Both conidia and ascospores were disseminated by the wind. The spread of the disease was promoted by warm, rainy weather, followed by periods of high humidity. *H. pruinatum* overwinters both in the mycelial stage and in the form of ascospores. On malt agar it grew best at 28° C. and at P_H 5 to 6.

PLAKIDAS (A. G.). **Arborvitae blight.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1117, 1943.

'Blight' or 'fire' of oriental arborvitae (*Thuja orientalis*), which has been prevalent in the southern United States for many years, especially on the Berkmann's Golden and Baker varieties, is characterized by the dying-off and brown discoloration of the leaves, small twigs, or whole branches, and often by the death of the entire tree. Similar symptoms also occur on the Italian cypress (*Cupressus sempervirens*). A species of *Cercospora* has been constantly found associated with the disease, which developed in a typical and severe form on plants inoculated with pure cultures or conidia-bearing twigs. The fungus was reisolated from the inoculated plants and found to resemble *C. sequoiae* and its var. *juniperi*, but differs from them in conidiophore length and growth rate in culture. The perithecia of a species of *Mycosphaerella* are commonly found on infected twigs, either alone or in conjunction with the conidial stage. Ascospore isolates were like those of the *Cercospora* in culture, but so far inoculations with the former have given negative results.

TRYON (H. E.). **Stem girdling of coniferous nursery stock by frost-heaved soil.**—*J. For.*, xli, 10, pp. 768–769, 1943.

Stem-girdling of young conifers by the mechanical action of frozen soil has been observed for several years past at the Forest Service Wind River Nursery, Carson, Washington, the species affected including Douglas fir (*Pseudotsuga taxifolia*), ponderosa and western white pines (*Pinus ponderosa* and *P. monticola*), Sitka spruce (*Picea sitchensis*), Port Orford white cedar (*Chamaecyparis lawsoniana*), and the Pacific silver, Shasta red, and noble firs (*Abies amabilis*, *A. magnifica* var. *shastensis*, and *A. nobilis*). The injury usually occurs in the autumn after the plants have become hardened, and during periods of alternate freezing and thawing, but has also been observed to take place before the close of the dormant stage in the spring. When only the outer bark is involved, a sloughing of the loosened portion is the sole noticeable symptom, but when the bark and cambial tissue are pushed up the stem they are pressed together in folds, leaving below a completely girdled

area, $\frac{1}{4}$ to 1 in. long. The bark above the girdled zone may remain folded or split on one side and hang loosely from its point of attachment. All the seedlings examined showed a swelling of the stem above the girdle due to an accumulation of foodstuffs, as well as an increase in girth of the entire upper portion associated with continued growth. Death usually ensues in the season following the injury.

F. Kaufert in (unpublished) work at the same nursery in 1929 described a partial or total girdling of conifer seedlings at or above soil-level caused by heat (cf. also C. Hartley in *J. agric. Res.*, xiv, pp. 595–604, 1918), but in this case the injury was accompanied by lesions, which were absent from the mechanically damaged trees. Complete girdling of young Douglas fir stems induced by high soil temperatures was also observed at a western Oregon forest nursery, but the part involved was invariably at soil-level, instead of $\frac{1}{4}$ to 1 in. above it, as in the frost-heaved soil injury.

Roth (L. F.) & Riker (A. J.). **Influence of temperature, moisture, and soil reaction on the damping-off of Red Pine seedlings by Pythium and Rhizoctonia.**—*J. agric. Res.*, xlvii, 7, pp. 273–293, 1 fig., 7 graphs, 1943.

A study of the influence of temperature, moisture, and soil reaction on damping-off of red pine (*Pinus resinosa*) seedlings in Wisconsin caused mainly by *Pythium irregulare* and *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xii, p. 158, and next abstract], carried out under controlled conditions in the greenhouse, showed that in uninoculated containers germination was poor at 12° and 15° C., good at 18° and 33°, and excellent at 21° to 30°, while subsequent seedling growth was best between 15° and 30°. *P. irregulare* killed over 90 per cent. of the seedlings at 12°, about 50 per cent. at 33°, and had intermediate effects at temperatures between these limits. *C. solani* caused damping-off in only a few seedlings at 12°, loss rising to a maximum of 58 per cent. at 24° to 30°, and declining again at 33°. The optimum temperature for the growth of both fungi in culture was 28°. At 4° *C. solani* approached a minimum, though *P. irregulare* still grew fairly well. At temperatures over 28° decline was more rapid for *P. irregulare* than for *C. solani*. Damping-off due to *P. irregulare* was at a minimum when the soil moisture content was 13 per cent. and increased to a maximum as it rose to 100 per cent.; that due to *C. solani* gradually rose from a high level at 13 per cent. soil moisture to a maximum at 68 per cent., after which it decreased to a minimum at saturation.

Air humidity had little or no effect on damping-off due to *P. irregulare*, but high air humidity increased the loss caused by the aerial mycelium of *C. solani*. In culture *P. irregulare* grew at P_H values from 3·7 to about 9, while it made best growth between P_H 5 and 8. *C. solani* grew from P_H 2·4 to about 9, growth being most rapid between about P_H 3·5 and 7·5. The optimum range for the development of red pine was from about P_H 4·7 to 6. With regard to damping-off, a broad range favourable for *P. irregulare* was found to lie between P_H 5·2 and 8·5. Below 5·2 the loss was comparatively small. There was a close relation between the rate of growth in culture and the severity of damping-off due to *P. irregulare*. The range from P_H 5·2 to 7·8 was only moderately favourable to *C. solani*, increase being rapid when acidity was stronger than P_H 5·2. Increase in damping-off by both fungi at levels over P_H 7 appeared to be connected with decline in host development. The distinct responses of the two fungi to the factors studied in the present work indicate that damping-off caused independently by *P. irregulare* and *C. solani* should be considered and treated as two diseases.

In the course of the work a method of controlling the moisture content of the top $\frac{1}{2}$ in. of soil, in which damping-off fungi are most active, was devised. Cylinders of different heights containing soil were stood in water and the height of the capillary column of water regulated the moisture of the surface soil.

Roth (L. F.) & Riker (A. J.). **Seasonal development in the nursery of damping-off of Red Pine seedlings caused by Pythium and Rhizoctonia.**—*J. agric. Res.*, lxvii, 11, pp. 417–431, 4 graphs, 1943.

Continuing their studies on the damping-off of red pine [*Pinus resinosa*] in Wisconsin forest nurseries caused by *Pythium irregulare* and *Rhizoctonia* [*Corticium*] *solani* [see preceding abstract], the authors made a detailed investigation of the effect on the disease of temperature, soil moisture, air humidity, and soil reaction. The experimental plots were inoculated with local strains of the two fungi, and data were taken at five- and three-day intervals throughout two seasons on equal numbers of seedlings. Seed was planted, and counts were made at regular intervals of time in order that the effects of environmental conditions might be observed on seedlings of comparable age. Only post-emergence damping-off was considered.

In 1938 damping-off increased throughout the summer as the temperature rose, the total losses for June, July, and August being, respectively, 11, 17, and 29 per cent., and the mean temperatures 67°, 71°, and 73° F. A decline near the end of July was probably conditioned by cooler weather and drier soil. For the season as a whole 54 per cent. of the total loss was caused by *P. irregulare* and 46 per cent. by *C. solani*. The two organisms, however, were not equally distinctive at all times, *C. solani* being the more important of the two during spring, and *P. irregulare* during summer. In June, July, and August, *C. solani* caused 79, 50, and 4 per cent., respectively, of the total loss. Increased temperatures favoured *P. irregulare* over *C. solani*, though some inconsistencies were noted. In the seven five-day periods when loss due to *P. irregulare* exceeded loss due to *C. solani*, the mean soil moisture was 7·2 per cent., whereas when *C. solani* predominated, it was 5·4 per cent.

In 1939, contrary to 1938, loss was greatest in spring, and declined from June onwards with declining temperature. Change in soil reaction did not influence total loss in either season. Liming reduced loss due to *C. solani* and increased that caused by *P. irregulare*. In normal plots in 1938, with P_H 5·5, the ratio of losses caused by *P. irregulare* and *C. solani* was 1 : 1; in 1939, at P_H 7 (same area) it was 4 : 1, and in watered plots over 5 : 1. From 8th August to 7th October the ratio in normal plots with P_H 7 was approximately 2·5 : 1. When the soil reaction was altered to P_H 5·5, the ratio again became about 1 : 1.

On the whole, *P. irregulare* became most active with relatively wet, not too acid soil and high temperature, while *C. solani* was more active in a relatively acid soil with low moisture and a low temperature. A single factor, or a combination of factors, operated at times to inhibit one fungus and favour the other. In both watered and normal plots more seedlings damped off 11 to 13 days after emergence than at any other age. After 13 days in the watered plots there was a sharp decline with increasing age until 17 to 19 days. At greater ages the loss became less marked, until at 32 to 34 days it dropped to under 1 per cent. After three weeks the losses in normal and watered plots were similar.

Riker (A. J.), Kouba (T. F.), Brener (W. H.), & Byam (L. E.). **White Pine selections tested for resistance to blister rust.**—*J. For.*, xli, 10, pp. 753–760, 1 fig., 1943.

Selections made in Wisconsin among native, young, cone-bearing white pine trees remained free from blister rust (*Cronartium ribicola*) after years of close proximity to *Ribes* bushes, including *R. missouriense*, *R. cynosbati*, and black currant. About 1,000 grafts and 10,000 open-pollinated seedlings from these trees, as well as commercial seedlings, were subjected to natural or artificial inoculation, or both, in the experimental nursery, with the result that a large proportion of the seedlings (up to 91 per cent.) developed cankers within a year. On the other hand, only a few of the grafts similarly treated became infected (maximum 5 per cent.), thereby affording encouraging evidence of resistance among some Wisconsin trees.

On the basis of these trials it is hoped that vegetative propagation by grafting and rooted cuttings may usefully supplement the *Ribes* eradication programme in the north-central States.

BEDWELL (J. L.) & CHILDS (T. W.). **Susceptibility of Whitebark Pine to blister rust in the Pacific Northwest.**—*J. For.*, xli, 12, pp. 904–912, 1943.

Studies of small trees in nursery beds in British Columbia, and of larger trees in natural stands there and in Idaho, Washington, and Oregon, have shown whitebark pine (*Pinus albicaulis*) to be much more susceptible to blister rust (*Cronartium ribicola*) than western white pine (*P. monticola*). The average number of cankers per tree in the natural stands was from a little less than 3 to over 30 times as great on the former as on the latter species. In 1928, in a plot in British Columbia containing 11 whitebarks 10 to 30 ft. in height, 40 somewhat taller western white pines, and 20 bushes of *Ribes lacustre* and *R. viscosissimum*, where the rust had become established in 1917 or 1918, the number of cankers on *P. albicaulis* was 26 compared with only two on *P. monticola*. At a re-examination in 1937 six of the whitebarks had been killed by the rust and the remaining five were thought to be incapable of more than another three or four years' survival, while one of the western white pines was also dead. Hundreds of cankers were present in *P. albicaulis*, which had been killed mostly by the girdling of individual twigs and branches rather than the trunks near the crown base. This type of killing is rare, occurring only where conditions are almost ideal for infection [*R.A.M.*, xiv, pp. 66, 135] or where highly susceptible species are exposed under at least moderately favourable conditions [ibid., xviii, p. 3]. In the same year an examination was also made of 21 whitebark pines, selected at random over the area in which the experimental plot was situated, up to an altitude of 3,800 ft. above sea-level; these were found to bear an average of 31 cankers each, and it was estimated that 11 would be killed by the rust during the next 5 to 20 years. In another area, at an elevation of 4,000 to 5,000 ft., inspected in 1937, nearly all the whitebarks less than 6 ft. in height, about half those from 6 to 15 ft. and one-tenth of those over 15 ft. bore destructive cankers, and the incidence of infection was increasing rapidly.

Evidence was obtained in the Mt. Hood region of Oregon that *C. ribicola* spreads from heavily infested *Ribes* to *P. albicaulis* over distances of three to four miles.

Among the factors contributing to the susceptibility of whitebark pine to blister rust may be the longer period of needle retention as compared with western white pine, the maximum for the former in eight study areas being 5·9 growing seasons and for the latter 4·4 [ibid., xii, p. 603]. *P. albicaulis* needles, moreover, are susceptible at all ages, while those of *P. monticola* are resistant during their first year [ibid., xviii, p. 149].

Pruning may be practised as an accessory to *Ribes* eradication where the scenic value of the whitebarks justifies the additional expense. Cuts should be made 3 or 4 in. below the proximal ends of the cankers, or if these are too close to the trunk, the bark on the latter should be excised for a distance of at least 2 in. from the end of the canker.

It is thought very unlikely that *C. ribicola* will spread from its present foci on *P. albicaulis* to the sugar pine [*P. lambertiana*] stands of California to any appreciable extent: the potential risk from this source to *P. monticola* in the Rocky Mountains cannot be assessed on the basis of the information at present available.

WEBER (G. F.). **A rust of Florida Pines caused by Cronartium quercuum (Berk.) Miya.**—*Proc. Fla Acad. Sci., 1940*, v, pp. 262–269, 1 diag., 1941. [Received March, 1944.]

The life-history, symptomatology, and mode of infection of *Cronartium quercuum*,

the agent of yellow pine blister rust in Florida, are fully described. Both the pine (*Pinus taeda, P. clausa, P. palustris,* and *P. australis*) and oak (about 25 species) hosts of the pathogen are widely distributed and of considerable economic importance in the State. The trunks and large branches of the pines bear spherical, oblong, or linear, gall-like swellings, by which they may be completely girdled. On oaks infection is confined to the foliage and assumes the form of yellowish blotches: on the lower surface of these are produced the yellow-orange uredosori and spores of the rust, which reinfect the oak during the summer and later give rise to the perfect (teleuto) stage, the source of inoculum for the pines. The latter are frequently attacked in the nursery, a total loss of stand ensuing when infection occurs on the main trunks of one-year-old seedlings. In a wet, grassy, open oak woodland near *P. taeda* seed trees containing thousands of one- to two-year-old 'volunteers', 43 per cent. of the two-year-old self-sown seedlings in a measured area chosen at random were found to be dead and remaining erect, while another 21 per cent. bore stem swellings. In another area, in which only one-year-old seedlings were counted, 7 per cent. were dead and 14 per cent. infected. Aecidiospore production by the pine galls is most abundant in the Gainesville district in March; infection of oaks by these organs takes place within a radius of half a mile.

The control of *C. quercuum* presents great difficulties owing to the prevalence of both hosts throughout Florida, but the annual pruning of the pine galls reduces spore production and thereby lessens the amount of inoculum for the oaks, while in planted forests diseased pines can be removed in the course of thinning operations. Such measures, however, are impracticable in dense woods or cut-over tracts. Pine seed-beds should as far as possible be located more than half a mile distant from the nearest oaks, while the repeated application of 2–4–50 Bordeaux mixture or some other standard fungicide might prove beneficial.

Discussing the taxonomy of the rust [*R.A.M.*, xviii, p. 73], concerning which the various authorities on the group are not agreed, the author proposes to apply the binomial *C. quercuum* (Berk.) Miyabe to the agent of branch galls on several species of Florida pines, notably *P. taeda*, with a wide range of southern oaks as its alternate hosts, and *C. strobilinum* Hedgc. & Hahn [ibid., xix, p. 173] to that of cone galls on *P. australis* and *P. palustris* (not *P. taeda*).

FENTON (E. W.). **Some observations on heart rot in conifers from an ecological point of view.**—*Forestry*, xvii, pp. 55–60, 1943.

A survey made in south-eastern Scotland from 1941 to 1943 showed that heart rot of spruce, Scots pine [*Pinus sylvestris*], and larch was common and widespread. *Polyporus schweinitzii* appeared to be the causal organism in Scots pine and *Fomes annosus* in spruce. Norway spruce [*Picea abies*] was the most susceptible tree. In Scots pine and larch the proportion affected was generally small, though in some localities the proportion showed rather wide fluctuations. The disease often seemed to commence in Scots pine after the age of 100 years, though it was seen in Scots pine trees 70 to 80 years old. In some woods spruce trees 50 years old or less showed a much higher incidence of heart rot than did others 70 years old or more. In most cases, however, the older spruce trees were chiefly affected. This was also the case with larch.

A definite correlation was found between heart rot in Scots pine and the presence of the moss *Leucobryum glaucum*; where the patches were large and plentiful, the heaviest damage was noted. Stagnant water and waterlogging of the soil increased heart rot, but where the water was fresh and drainage satisfactory the incidence of the disease was low. In areas where the grass *Holcus mollis* was dominant there was a definite increase in heart rot, as there was also, though to a smaller extent, where *Agrostis tenuis* was plentiful. Dunging and grazing by sheep increased heart rot, the evidence indicating that certain grassy types of vegetation, such as *Holcus*

and *Agrostis*, approach an agricultural standard of fertility near to that recognized as causing heart rot in conifers on agricultural land. Some increase in heart rot was noted where *Lastrea filix-mas* and *L. dilatata* dominated the floor of the wood.

One important finding was that in spite of the increase in heart-rot incidence in the presence of certain types of vegetation, there were always some sound trees. This suggests that some strains of conifers are resistant.

ETTLINGER (L.). **Das Triebsterben der Kiefern und sein Erreger.** [The die-back of Pine shoots and its agent.]—*Ber. schweiz. bot. Ges.*, liii, pp. 469–470, 1943.

Crumenula abietina (*Brunchorstia destruens*) [*R.A.M.*, xx, p. 41] was found to be the agent of a die-back of pine (*Pinus cembra* and other species) shoots in Alpine afforestation areas. A similar, hitherto unobserved disease of larches is referred to *C. laricina* n.sp., characterized by asci measuring 66 to 107 by 5 to 9 μ, hyaline, uniseptate ascospores, 9 to 16·5 by 2·5 to 3·5 μ, and hyaline, uniseptate conidia, 10 to 21 by 2·5 to 3·5 μ. The fungus responsible for a shrivelling of spruce crowns, described by H. C. Schellenberg in 1906, was identified as *Valsa friesii* [ibid., xviii, p. 74] and its suspected connexion with *Cytospora pinastri* verified. *B. gibbosa*, hitherto reported once from America, was collected in the Lucerne district.

[DAY (W. R.).] **Forest pathology.**—*Rep. Imp. For. Inst., Oxford, 1942–43*, pp. 6–7, 1943.

In this report [cf. *R.A.M.*, xxi, p. 234] it is stated that Scots pine [*Pinus sylvestris*] in Kent was attacked by *Melampsora pinitorqua* [ibid., xix, p. 376]. The outbreak appeared to be only local. An isolated example of *Peridermium cornui* [ibid., xix, p. 68] was observed on a Scots pine near Thetford, Norfolk. *Adelopus* [*Phaeocryptopus*] *gaeumanni* [ibid., xx, p. 330; xxi, p. 434; xxii, p. 162], one of the causes of needle-cast on Douglas fir, was ascertained to be generally distributed in Welsh forests. So far no serious damage has occurred, but the plantations should be watched. At Easter die-back was actually taking place in some of the European larch plantations affected by disease and was, moreover, conspicuous. Most of this die-back resulted from the girdling of side twigs or branches, girdling very often occurring at places where there was no canker. Frost appears to be the real cause of this girdling, but its full development needs to be followed under field conditions.

LEIBUNDGUT (H.) & FRICK (LOUISE). **Eine Buchenkrankheit im schweizerischen Mittelland.** [A Beech disease in the Swiss interior.]—*Schweiz. Z. Forstw.*, xciv, 10, pp. 297–306, 2 pl., 2 figs., 1 graph, 1943.

A die-back of beeches (mostly dominant and co-dominant, 60- to 120-year-old trees), first observed at Winterthur, Zürich, in the summer of 1940 and subsequently spreading to other localities, is attributed in the first place to the exceptionally severe winter of 1939 to 1940, when the mean January temperatures fell to $-4°$ to $-5·5°$ C. below normal [cf. next abstracts]. The affected trees bore reddish stripes, consisting of the perithecia of *Nectria coccinea* [*R.A.M.*, xxi, p. 185] and usually running vertically along one side of the trunk. The fungus was isolated on malt agar (2 : 1·5 per cent.) on which its optimum and maximum temperatures were determined as between 18° and 24° and 33°, respectively; the minimum could not be ascertained, since cultures transferred after four weeks at $-3°$ to the optimum rapidly produced normal colonies, indicating that the fungus would be able to survive under natural conditions. The mean ascospore dimensions of the Winterthur isolates in pure culture were $11·8 \pm 1·3$ by $5·1 \pm 0·5$ μ, and of the macroconidia $25·7 \pm 5·6$ to $58·5 \pm 3·8$ by $4·9 \pm 0·7$ μ; the majority of the latter organs had only four cells instead of the six reported by Wollenweber [ibid., x, p. 626]. Inoculation experiments with *N. coccinea* were successful only through

injuries, and in no case did the spread of infection exceed 6 cm. from the site of entry or involve the sound tissues. The fungus is therefore to be regarded only as a contributory cause of the die-back. Sun scorch may also have been implicated, since most of the affected trees had a dark-coloured (greenish-brown to black) cortex and were consequently subject to abrupt daily fluctuations of temperature, and moreover, the damage occurred principally on the sides of the trunks facing south and south-west.

LARSEN (P.). **Die Bedeutung der Winterkälte für die Kernbildung der Buche.** [The significance of winter cold in relation to heart formation in the Beech.]—*Schweiz. Z. Forstw.*, xciv, 9, pp. 265–272, 6 figs., 1943.

'Red heart' formation occurred extensively among beeches [*R.A.M.*, vii, p. 691 and next abstract] in Danish forests in 1943, phenomenal features of the condition including the suddenness of its appearance, the exceptional involvement of young (40- to 60-year-old) trees, and the peculiar colour of the wood, in some cases darker and in others greyer than usual. In this connexion the writer summarizes previous observations by himself and other workers on the etiology of 'red heart', which he regards as a physiogenic disorder, fungal intervention being of secondary importance. The remarkable outbreak of the trouble in Denmark is attributed to the abnormally severe winter of 1941–2, during which (in January) the temperature fell to −30° C. in many places.

KNUCHEL (H.). **Ergebnisse eines Versuches mit nicht imprägnierten und imprägnierten Buchenschwellen verschiedener Fällzeit.** [Results of an experiment with unimpregnated and impregnated Beech sleepers felled at different times.]—*Schweiz. Z. Forstw.*, xciv, 3, pp. 83–88, 6 figs., 1943.

On 10th October, 1941, three beechwood sleepers, buried seven years previously at a depth of 25 cm. in meadow soil after impregnation with coal tar by the Rüping process at the rate of 178 to 180 kg. per cu. m., were found to be in perfect condition. In the case of the 25 untreated sleepers excavated at the same time after an identical period of burial, the majority were almost or completely decayed. A decisive influence of the season of felling was not observed [*R.A.M.*, x, p. 146]. 'Red heart' [see preceding abstract] did not prevent, though it may slightly delay, the rotting of untreated wood, and in impregnated sleepers such heartwood, which does not absorb coal tar, constitutes the zone of incipient disorganization. Sleepers stacked at the base of the pile and thus 'asphyxiated' by proximity to the damp ground before burial were badly decayed, as also were those with extensive fissures.

NEWINS (H. S.). **Chemical seasoning of lumber.**—*Proc. Fla Acad. Sci., 1940*, v, pp. 85–95, 2 graphs, 1941. [Received March, 1944.]

In connexion with an account of experiments in the chemical seasoning of tidewater red cypress (including *Taxodium distichum* and *T. ascendens*) in Florida, mention is made of the promising results obtained with crystal urea, which has been found to confer resistance to wood-destroying fungi at concentrations as low as 0·2 per cent. [*R.A.M.*, xxiii, p. 159.]

EADES (H. W.). **Investigation of brown streak in Western Hemlock used for aircraft purposes.**—*B.C. Lumberm.*, xxvii, 11, pp. 50, 52, 1943.

The writer made an examination of a number of western hemlock [*Tsuga heterophylla*] flitches, 4 ft. in length, originating in different parts of British Columbia, to determine the cause of the defect known as 'brown streak', 'water-soak', 'water-core', 'wetwood', 'glassy-wood', and (quite erroneously) 'mineral stain' [cf. *R.A.M.*, xxii, p. 184]. The streaks involved from 3 to 14 growth rings, each

of which contained a high proportion of late wood, and were uniformly water-soaked. Another form of dark streak, not observed in the present lot of material, connotes the incipient stage of fungal infection, e.g., by *Ganoderma oregonense* [ibid., xxiii, p. 124]. Dark-streaked wood should not be used for aircraft construction, since weakening factors are likely to be present, whatever form the defect assumes.

Other blemishes common in western hemlock are 'white streak' and 'black streak', also known as 'black check' or 'black seam'. 'White streak' appears on freshly surfaced boards as finely etched, longitudinal lines, up to several inches in length but no wider than the scratch of a pin point or thumb nail. The white ingredients of the cell lumina consist of resins or fats which are readily dissolved in glycerine, xylol, and other solvents. The wood is not in the least weakened either by 'white streak' or 'black streak', which is usually due to insect attack on the living tree.

KIMMEY (J. W.) & FURNISS (R. L.). **Deterioration of fire-killed Douglas Fir.**—*Tech. Bull. U.S. Dep. Agric.* 851, 61 pp., 8 figs., 3 diags., 8 graphs, 1 map, 1943.

Fungi and insects were found to be the chief agents of deterioration in fire-killed Douglas fir (*Pseudotsuga taxifolia*) in a six-year investigation of 602 trees in 63 representative areas of western Oregon and Washington. Since the two groups of organisms were usually closely associated and often interdependent, their effects were considered primarily in combination.

Wood stain (*Ceratostomella* spp.) was of considerable importance in relation to the loss of sapwood, but only during the first three years after fire. The wood-rotting fungi fell into two groups, of which one caused decay in the sapwood only and the other in both sap- and heartwood. *Polyporus* [*Polystictus*] *abietinus* was the principal species implicated in the former type of damage, being responsible for over 50 per cent. sapwood decay, and *Fomes pinicola* in the latter: this fungus induced nearly as much rot in the sapwood as *P. abietinus* and over 75 per cent. in the heartwood. Two other species causing considerable decay both in sap- and heartwood were *F. officinalis* and *Lenzites sepiaria*, while *Polyporus volvatus* and *Stereum* spp. were very injurious to the sapwood only.

Fungal and insect deterioration in fire-killed Douglas fir starts immediately below the bark and proceeds fairly uniformly from the periphery to the centre of the bole. So rapid is the process in the sapwood that it is usually unsaleable three years after a fire, the heartwood disintegrating more slowly. Trees of the young (12 to 60 in. diameter at breast height), intermediate (22 to 74 in.), and old (27 to 104 in.) growth types deteriorated in 3 to 4, 10 to 15, and 15 to 20 years, respectively; in the last-named disorganization was ordinarily incomplete until 60 years or more after death. Rates of deterioration appear to be generally similar in fire-killed Douglas fir of the Coast and Cascade forest types, and in felled and standing trees. No doubt such factors as rainfall, slope, exposure, and elevation exert an effect on the rate of deterioration, but they were so much obscured by the influence of the character of the wood, growth ring width (wide rings accelerating decay), and so forth, that their individual contributions to the disorganization of the timber could not be assessed within the limits of these studies.

DALE (W. T.). **Preliminary studies of the plant viruses of Trinidad.**—*Trop. Agriculture, Trin.*, xx, 12, pp. 228–235, 1943.

Cowpea mosaic [*R.A.M.*, xxi, p. 514] spread rapidly in certain crops during 1942, but mosaic of woolly pyral (*Phaseolus mungo*) due to the same virus was even less common in 1942 than in 1929. Soy-beans also appeared to be attacked by common cowpea mosaic, and when experimentally inoculated with the virus very

young seedlings were seriously affected. Sunn hemp (*Crotalaria juncea*) showing mosaic symptoms proved to be infected by cowpea mosaic virus. Lima beans (*P. lunatus*) were artificially infected with cowpea mosaic, though the percentage of successes was low (40 per cent.). The pure white Carolina Lima and black mottled varieties appeared to be equally susceptible. Pigeon pea seedlings were infected in the greenhouse. Over 800 seedlings of the 'gub-gub' variety of cowpeas, raised from the seed of plants infected when young, showed no sign of mosaic, though grown until the expansion of the second compound leaf. A preliminary test indicated that *Ceratoma ruficornis* may be a vector.

Common bean mosaic is also prevalent in Trinidad, producing symptoms resembling those found in the United States, whence much bean seed is imported. Most seed samples of bush beans in Trinidad give rise to a small percentage of mosaic plants. Seed transmission does not seem to occur often when the parent plant becomes infected after flowering, and the percentage is much lower when infection occurs during the growing season than when the plants have been diseased throughout the season.

The tobacco mosaic found in Trinidad is due to a typical strain of *Nicotiana* virus 1 and the same virus causes a mosaic of *Capsicum annuum* and mild mosaic in tomato.

In Trinidad small loss from breaking and crumbling of the leaf in curing results when tobacco is infected with the mosaic virus and the check to growth appears to be slight compared with the effects of waterlogging. The loss caused to tomatoes by mild mosaic is negligible. The virus causes serious losses in peppers, but these are grown only on a minor scale.

WARNE (L. G. G.). **An outbreak of club-root traceable to a seed-borne infection.**—*J. R. hort. Soc.*, lxix, 2, pp. 45–47, 1944.

The information in this paper has been noticed from another source [*R.A.M.*, xxii, p. 52].

ZAUMEYER (W. J.) & HARTER (L. L.). **Two new virus diseases of Beans.**—*J. agric. Res.*, lxvii, 8, pp. 305–328, 3 figs., 1943.

This paper describes two new closely related viruses of bean (*Phaseolus*): bean mosaic virus 4 (southern bean mosaic virus 1) and bean mosaic virus 4A (southern bean mosaic virus 2). The exact distribution of these viruses is unknown, but bean mosaic virus 4 occurs in Louisiana and 4A in California, Colorado, Idaho, and Maryland.

The local lesions produced by virus 4 on Ideal Market are generally almost circular, brownish-red, and they often have light centres. They vary from 1 to 3 mm. in diameter. On most varieties they are rather diffuse or spreading. When the virus is concentrated, they may be so numerous as to coalesce, often causing the leaf to die and drop off. When they are located near the veins, the tissue may become necrotic for a distance of 1·5 to 3 cm. from the site of infection. The systemic or mottled symptoms occur only on plants not showing local lesions. The first sign of infection is a mild mottle of the trifoliate leaves, which later becomes intense. Veinbanding is common, the interveinal tissue being a lighter green than the tissue adjacent to the veins. The leaves may be puckered and blistered. Very mild symptoms are produced on Stringless Green Refugee and the mosaic resistant Refugee varieties. On some varieties vein necrosis, which may cause the leaves to drop off, occurs on the young trifoliate leaves. Reduction in leaf size and malformation occur in highly susceptible varieties. Pod symptoms appear as dark green, irregular, water-soaked, blotched areas in green-podded beans, and as greenish-yellow areas on wax-podded types. Infected pods of susceptible varieties are malformed, of subnormal length, and often curled at the end.

The local lesions produced by virus 4A resemble those caused by virus 4, but have more distinct edges. The systemic symptoms are less severe than those due to virus 4 in the early stages but are more severe in the later ones.

Of 80 bean varieties or strains tested, none was fully resistant to either virus. Twenty-four varieties were homozygous for susceptibility to the local lesion infection of virus 4, 8 were heterozygous, and 48 were resistant. The resistant varieties were susceptible to systemic infection, and the heterozygous were resistant. Thirty varieties were susceptible to the local lesion infection of virus 4A, and 6 of these were heterozygous; 50 varieties were resistant, all being susceptible to systemic infection. *P. lunatus* and closely related hybrids between *P. lunatus* and *P. lunatus* var. *macrocarpus* were susceptible to local infection by both viruses, whereas the Fordhook types were completely resistant. The Virginia variety of soy-bean was the only other susceptible to both viruses found among 31 species, representing 20 genera in five families.

Local lesions were produced by both viruses at temperatures ranging from 16° to 27° C. They appeared most rapidly at 27°. The systemic symptoms of virus 4 appeared in 8 days at 18° to 27°, and were most severe after 20 days at 18°.

Both viruses were isolated from seed in the milk and dough stage and from freshly ripened seeds, but 4A alone was isolated from seed stored in the laboratory for seven months. About 5 per cent. of such seed produced diseased plants. Both viruses were obtained from all parts of the systemically infected green plant.

The viruses were inactivated between 90° and 95°, were infectious at 1 to 500,000 dilution, and resisted ageing *in vitro* at 18° for 32 weeks. Virus 4 was infectious after 30 minutes' treatment with 95 per cent. alcohol; it was inactivated by a 1 to 100 nitric acid dilution in one test, but not by a 1 to 50 dilution in another. It was not destroyed by a 1 to 100 dilution of 37 per cent. formaldehyde for 30 minutes, and was not inactivated by 30 minutes' treatment in a 5 per cent. solution of sodium chloride. Both viruses were separated from a mixture of bean viruses 1 and 2 by heating above 60° for 10 minutes or diluting the extract above 1 to 2,000.

Zaumeyer (W. J.) & Harter (L. L.). **Inheritance of symptom expression of Bean mosaic virus 4.**—*J. agric. Res.*, xlvii, 7, pp. 295–300, 1 fig., 1943.

Investigation of the inheritance of the symptom expression of bean mosaic virus 4 (southern bean mosaic virus 1) [see preceding abstract] showed that it is governed by a single allelomorphic pair of Mendelian factors. Plants carrying the dominant allelomorph are susceptible to local lesions, while the homozygous recessive plants are susceptible to systemic infection, with resultant leaf-mottling, stunting, and loss of yield. Varieties possessing the dominant gene for virus localization are regarded as possessing commercial resistance and are being used in breeding work.

Reid (W. D.). **Resistance of beans against bacterial-wilt, anthracnose, and Bean-mosaic.**—*N.Z. J. Agric.*, lxvii, 6, pp. 411–412, 1943.

A brief, popular account is given of the symptoms and control of bacterial wilt of beans [*Pseudomonas medicaginis*: *R.A.M.*, xix, p. 644], bean anthracnose [*Colletotrichum lindemuthianum*], and bean mosaic. All these are present in New Zealand, but the last-named is not of major importance in crop production. Under New Zealand conditions it has not been found practicable to grow bean seed in areas where bacterial wilt does not occur. Hot water treatment and treatments with mercurial dusts have not proved satisfactory. Roguing is suitable for small growers, but spraying has not given good control of bean diseases. During the last six years 40 bean varieties have been tested at Auckland and periodically at Palmerston North for resistance to these diseases. In these trials all runner varieties were resistant to bacterial wilt, anthracnose, and mosaic; Burnley Selections of Canadian Wonder and Dun were highly resistant to bacterial wilt and

mosaic, but the former was susceptible to anthracnose; while Black Prince, Blue Pod, Woods Centenary, Dun, and Zulu King were moderately resistant to all three diseases. There is no guarantee at present that commercial lines of seed are disease-free, and in areas where disease is prevalent, resistant varieties should be sown. Small growers can use either disease-free seed or resistant varieties.

STRAIB (W.). **Untersuchungen zur Biologie und Bekämpfung des Bohnenrostes Uromyces phaseoli (Pers.) Wint.** [Investigations on the biology and control of the Bean rust *Uromyces phaseoli* (Pers.) Wint.]—*Gartenbauwiss.*, xvii, pp. 397–445, 1943. [Abs. in *Chem. Zbl.*, cxiv (ii), 18, p. 1662, 1943.]

All German bean varieties have been found susceptible to rust (*Uromyces phaseoli*) [*U. appendiculatus*], the control of which should be based on the collection and destruction by burning *in situ* of fallen leaves; disinfection of supporting poles with 0·1 per cent. formalin; and repeated prophylactic applications of Bordeaux mixture or other standard fungicides, sulphur dusting being possibly also feasible in regions with a low summer rainfall.

ELLIS (D. E.). **Soil treatments with sodium nitrite for controlling damping-off and root knot.**—Abs. in *Phytopathology*, xxxiii, 12, pp. 1110–1111, 1943.

Damping-off of lettuce (*Rhizoctonia*) [*Corticium solani*] was effectively combated in greenhouse and seed-bed tests in 1942 and 1943 by the application to the soil of sodium nitrite, of which 4 and 8 oz. per sq. yd., incorporated into artificially infested soils four weeks before sowing, reduced the post-emergence phase of the disease by 71 and 95 per cent., respectively. At the higher dosage the compound caused a slight reduction in the stand, but gave better control than chloropicrin, formaldehyde, or urea.

MADER (E. O.). **Some factors inhibiting the fructification and production of the cultivated Mushroom, Agaricus campestris L.**—*Phytopathology*, xxxiii, 12, pp. 1134–1145, 1943.

A study of the conditions relating to mushroom (*Agaricus* [*Psalliota*] *campestris*) fructification and production, conducted in part in a limestone mine at West Winfield, Pennsylvania, and in part at the mushroom plant of Yoder Bros., Barberton, Ohio, revealed accumulations of noxious volatile substances, which in the mine tended to be more abundant in the inside than in the outside rooms. These differences were experimentally shown to be associated with the lack in the inner chambers of the natural ventilation on which air exchange in the mine depends. The sealing-up of mine rooms or experimental chambers, by permitting the concentration of the deleterious exhalations, resulted in the complete cessation of fructification. Sporophores exposed to these conditions either developed into fruit bodies of gigantic dimensions and abnormal shape, or grew only at the base of the stipe after the manner of an onion.

There was no macroscopic difference between the mycelium of mushrooms grown in the presence or absence of the volatile substances, which proved amenable to elimination by washing the atmosphere with alkaline potassium permanganate solutions, mineral oil, or activated charcoal, indicating that they probably belong to the class of non-saturated hydrocarbons, though their exact nature is unknown. The substances in question are assumed to be metabolic products either of the mushrooms themselves, or of the microflora inhabiting the growing media.

OSTERWALDER (A.). **Von teilweisen Lahmstieler-Trauben.** [On Grapes with partial pedicel lameness.]—*Schweiz. Z. Obst- u. Weinb.*, lii, 26, pp. 635–638, 1 diag., 1943.

'Pedicel lameness' in grapes is due to several causes. Grey mould (*Botrytis*)

[*cinerea*], for instance, frequently spreads from the rotting fruits to their stalks and thence to the main pedicel, ultimately cutting off the water supply so that the grapes become flaccid or 'lame', the heavier ones tending to break off at the soft, decayed site of infection, which is often surrounded by a grey down, consisting of the hyphae and spores of the fungus. This form of the trouble may be combated by the addition to the last *Peronospora* [*Plasmopara viticola*] spray of 200 gm. cotton oil soft soap (Maag, Dielsdorf) per 100 l. Bordeaux mixture.

The agent of white rot (*Coniothyrium*) [*diplodiella*] may also cause 'pedicel lameness' by spreading from the stalks of the bleached, roughened, insecurely attached fruits to the main pedicel.

A third form of 'pedicel lameness' in hybrid bearers, though associated with the presence in the tissues of various fungi, including *Gloeosporium*, *Fusarium*, and *Phoma* spp., is attributed to meteorological factors, especially high temperature.

SCOTT (L. E.). **Boron nutrition of the Grape.**—*Soil Sci.*, lvii, 1, pp. 55–65, 1944.

In an experimental vineyard comprising 50 vine varieties on a deep phase of Norfolk sand near Columbia, South Carolina, foliar symptoms suggestive of boron deficiency were observed in June, 1939, when the plants were five to nine years old. The leaves bore a well-defined pattern, with chlorotic areas towards the margin and between the veins, and their surfaces were abnormally rugose, with raised interveinal zones which induced a cupping of the under sides. Blossom-clusters were formed, but very few fruits were set, the grape yield also being greatly reduced on some vines showing little external evidence of boron deficiency. The Armalaga, Catawba, and some other varieties exhibited the phenomenon known as 'millerandage' consisting in the setting of parthenocarpic or seedless fruits. The application of borax to the soil at the rate of 10 lb. per acre corrected the deficiency symptoms and resulted in the production of heavy fruit crops, this improvement in the health of the vines being accompanied by an increase in the boron content of the foliage: in the Lenoir variety, for instance (in which the stems were also analysed), the leaves below, adjacent to, and above the clusters, the clusters and the stems below, adjacent to, and above the clusters of the treated plants contained 53, 47·3, 39, 38·6, 31·9, 27·6, and 33·5 p.p.m. boron, respectively, while the corresponding figures for the untreated were 40·3, 36, 30, 34·6, 25·2, 17·5, and 32, respectively. Varietal differences in response to boron deficiency were very noticeable. Thus, Ontario, Cayman, Armalaga, Lomanto, Seneca, and Genara were an almost total failure, Catawba, Bailey, Lenoir, Concord, Extra, Herbat, and Niagara belonged to the moderately affected group, while Champion, Portland, Fredonia, R. W. Mumson and Isabella showed few or no foliar symptoms, though there may have been a reduction of yield in some instances. The borax content of the vines was at a minimum in the early part of the growing season, and the deficiency symptoms seldom developed in the later growth.

WALLACE (MAUD M.). **Sclerotinia disease of Beans and other crops.**—*E. Afr. agric. J.*, ix, 3, pp. 171–172, 1944.

In June, 1942, French beans on a farm at Mondul, Northern Province, Tanganyika Territory, were found to be infected by *Sclerotinia sclerotiorum*. Though a first record for the Colony there is little doubt that the fungus had been present a number of years. Immediate steps were taken to destroy the affected material. In June, 1943, the disease occurred in many bean fields and on other plants at Machame, on Kilimanjaro, and it was also noted on beans at Oldeani. A field of sunflowers at Machame sustained a loss, due to infection by the fungus, estimated at from 30 to 40 per cent. of the crop. Tomato plants growing wild at Machame were also attacked. Potatoes showed slight stem infection. Dahlias,

Tropaeolum, and *Eschscholtzia* were lightly affected at Machame. The fungus was first observed in Kenya in 1941, where Nattrass states it attacked pyrethrum [*Chrysanthemum cinerariifolium*] and other crops.

The symptoms of the disease are described. Infected material should be dried in heaps and then burned. In areas where infection is endemic the chief preventive measure consists in the avoidance of too close planting of susceptible crops, and of interplanting with other crops. Weeds should be kept down and adequate drainage provided. It may be advisable to sow resistant crops, such as cereals or perennials. Deep cultivation results in the burial of many sclerotia. In a season favourable to the disease successful control is not to be expected.

Leach (J. G.) & Clulo (Genevieve). **Association between Nematospora phaseoli and the green stinkbug.**—*Phytopathology*, xxxiii, 12, pp. 1209–1211, 1943.

Yeast spot (*Nematospora phaseoli*) [*R.A.M.*, ii, p. 194] of Lima beans [*Phaseolus lunatus*] is common in south-eastern Virginia, but has seldom been observed in West Virginia, where a fairly extensive survey carried out in 1941 also failed to reveal its presence notwithstanding the prevalence of the supposed insect vector, *Nezara hilaris*. The fungus was, however, readily isolated from the surface of insects collected on spotted plants in south-eastern Virginia by S. A. Wingard, though cultures from the aseptically dissected internal organs were negative. Since the food channel of adult stinkbugs rarely exceeds 12 μ in diameter, and the salivary channel is several μ smaller, while the majority of mature cells of *Nematospora phaseoli* range from 10 to 20 μ in diameter, the possibility of internal biological transmission through this agency appears remote. From these observations it may be inferred that the conveyance of the fungus from diseased to healthy plants by *Nezara hilaris* is entirely external and mechanical, the insects presumably acquiring the inoculum during the spring. The natural host range of *Nematospora phaseoli* requires further investigation, preferably in milder regions where it is more abundant than in West Virginia. According to Underhill (*Bull. Va agric. Exp. Sta.* 294, 1934), the stinkbug prefers certain weeds to *P. lunatus*, and in this case the elimination of the former might offer a practical means of control.

Richards (B. L.) & Burkholder (W. H.). **A new mosaic disease of Beans.**—*Phytopathology*, xxxiii, 12, pp. 1215–1216, 1943.

In 1939 Michelite pea beans near Batavia, New York, were so heavily infected by a disease apparently identical with mosaic that harvesting was impracticable. Since the variety in question had previously been reported to be resistant to the virus (*Spec. Bull. Mich. agric. Exp. Sta.* 295, 1938), this new development occasioned some surprise. Of recent years, moreover, many complaints have been received from growers concerning the increasing susceptibility to mosaic of the normally immune Robust variety. In 1942 tests with an isolate of the virus from a plant grown in New York State on a number of samples of Robust and Michelite showed these two varieties to be fully susceptible to inoculum from this source, whereas in subsequent experiments with three strains from New York, and one each from California, Idaho, and the Canal Zone, they were attacked only by two from the first-named locality. It is evident from these data that the bean mosaic virus comprises two strains or entities, both seed-transmissible and producing virtually identical symptoms. Further trials showed the Red Kidney and Bountiful varieties to be susceptible to both; Norida, Red Mexican 3, and Great Northern, as well as Michelite and Robust, susceptible to the 'new' but not to the 'old' strain; and Great Northern 1 and 59, Ashley's and Cooper's Wax, and Refugee immune from both. Hybridization experiments aiming at the production of an immune white bean are in progress.

DOYER (L[UCIE] C.). **De beteekenis van het zaad als overbrenger van ziekten en plagen in groentegewassen.** [The importance of the seed as a conveyor of vegetable diseases and pests.]—*Tijdschr. PlZiekt.*, xlvii, pp. 14–24, 1941. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 1–4, pp. 76–77, 1943].

The following fungal pathogens of vegetables have been found to be carried over in the seed: *Ascochyta pisi* and *Mycosphaerella pinodes* on peas, *Colletotrichum lindemuthianum* and *Macrosporium commune* [*Pleospora herbarum*] on beans, *Peronospora spinaciae* [*P. effusa*], *Phoma* sp., and *Fusarium* sp. on spinach, *Botrytis allii* and *M. parasiticum* [*Pleospora herbarum*] on onions, *Septoria apii* on celery, *S. petroselini* on parsley, and various *Alternaria* spp. on cabbage. Information concerning the incidence of infection and appropriate control measures is given in most cases.

PRESTON (N. C.). **Club root disease.**—*Gdnrs' Chron.*, Ser. 3, cxv, 2987, p. 128, 2 figs. (1 on p. 129), 1944.

Excellent control of club root [*Plasmodiophora brassicae*] in Brussels sprouts was secured in Shropshire in 1943 by the immersion of the seedling roots in a paste consisting of $1\frac{1}{2}$ lb. 4 per cent. calomel [mercurous chloride] dust in 11 fluid oz. water immediately before planting out on 22nd June in a heavily infested plot that had been under *Brassicae* for the past 15 years. Two pickings were made, one on 19th November and the second on 5th January, 1944: at the former the treated and untreated plants yielded 44 and 7 lb., respectively, of marketable sprouts, the corresponding figures for the latter being 25 and 5 lb., respectively. On lifting the plants after the second picking, 43 of the treated and 80 of the untreated were found to be severely clubbed, 57 of the latter being almost completely rotted, while moderate to very light infection was observed on 52 and 7, respectively, in the two classes. In general, 1 lb. of the dust should suffice for the treatment of about 100 plants.

HADORN (C.). **Eine Rotbrenner–Epidemie in den Reben der Bündner Herrschaft.** [A 'rotbrenner' epidemic among the Vines of the Canton of Grisons.]—*Schweiz. Z. Obst.- u. Weinb.*, lii, 25, pp. 616–626, 1 fig., 1 graph, 1943.

A severe epidemic of 'rotbrenner' (*Pseudopeziza tracheiphila*) in the Canton of Grisons in 1943 was at first attributed by vintners to the use of the red Sandoz copper spray, necessitated by the recent order that 40 per cent. of the total Swiss copper consumption for agricultural purposes shall be taken in this form. The weather in the spring of 1943, however, was highly conducive to the epidemic development of the pathogen, the long dry spell from 10th April to 25th May having been followed by showers which permitted abundant apothecial production in the rotting leaves, and subsequently by a wet period from 7th to 18th June, when these organs ripened and liberated a profusion of ascospores for mass infections. The development of the fungus was further promoted by the check to the growth of the host coinciding with inclement weather in June, succeeded by another drought.

In view of the abnormal climatic conditions, only the most efficient spraying campaign could have afforded adequate protection during the protracted critical period for infection. The first treatment should have been given from 20th to 24th May, followed by a second from 30th May to 6th June. The latter was omitted by many growers. The Sandoz copper spray at 0·3 per cent. is considered adequate for the control of *P. tracheiphila*, though a somewhat superior, and notably a more prolonged effect is exerted by 1·5 to 2 per cent. Bordeaux. A 'rotbrenner' epidemic may be anticipated when a relatively dry winter with little snow is followed by a drought in April or May, and in such seasons a precautionary treatment should be given about 20th May, ten days or so before the first regular downy mildew application, and repeated at 10- to 14-day intervals.

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THOMAS (C. A.). **Studies on the Fusarium-wilt disease of the Sweet Potato (Ipomoea batatas Poir.).**—*Proc. La Acad. Sci.*, vii, pp. 23–24, 1943.

In studies on *Fusarium batatatis* and *F. hyperoxysporum* [*F. bulbigenum* var. *batatas* and *F. oxysporum* f. 2: *R.A.M.*, xxii, p. 456] from sweet potato in Louisiana, the former was found to be less pathogenic than the latter. Variations in cultural characters were not common. No sectoring was noted. By selecting a single macro- or microconidium the production of macroconidia was increased, the increase being greater in *F. oxysporum* f. 2 than in *F. bulbigenum* var. *batatas*. The identification of these fungi was based on the growth characteristics on a rice medium and on potato cylinders. *F. bulbigenum* var. *batatas* presented a powdery appearance on potato, and when the stroma covering the substratum became shrivelled, many small, blue blisters of sclerotial plectenchymata formed. *F. oxysporum* f. 2 on potato first produced abundant white mycelium and after drying had a gelatinous appearance. On rice medium the former produced a powdery orange colour, dark blue to purple blisters appearing on the substratum in age, while *F. oxysporum* f. 2 produced a dark red colour, turning blue in age. This fungus is more prevalent than *F. bulbigenum* var. *batatas* in Louisiana.

PRYOR (D. E.). **The big vein disease of Lettuce in relation to soil moisture.**—*J. agric. Res.*, lxviii, 1, pp. 1–9, 1 fig., 2 graphs, 1944.

Experiments on the relation of soil moisture to big vein of lettuce [*R.A.M.*, xxi, p. 513], a disease of obscure etiology transmitted by the soil, were carried out in pots with two different soils from affected areas in California, one near Salinas and the other in the Imperial Valley. The results showed that the number of plants developing the condition increased as moisture increased from 35 to 85 per cent. of capacity. Many diseased plants were present even at moisture levels below the optimum for lettuce, and a few plants became affected when supplied with only enough water to keep them alive. Incidence was highest in the treatments that gave the largest plants.

With each increment of moisture plant weight increased. In each series the most vigorously growing lettuces appeared to be those most readily affected, but the earlier a plant developed the condition the smaller was its final weight. Diseased plants raised on Salinas soil seemed to be larger than healthy plants in the same pot, while the reverse was true on Imperial Valley soil, the difference being attributed to the larger growing period for plants on the latter soil.

It is recommended that resistance trials should be carried out in well-watered soil. There appears to be little hope of reducing big vein in commercial fields through the control of soil moisture.

WALKER (J. C.). **Histologic-pathologic effects of boron deficiency.**—*Soil Sci.*, lvii, 1, pp. 51–54, 1944.

This is a condensed version of the author's studies (with J. P. Jolivette) on the pathological histology of boron deficiency in the garden beet and cabbage, already

noticed from another source [*R.A.M.*, xxii, p. 335]. A common observation in beets grown for canning in Wisconsin is the sudden appearance of internal black spot just before harvest notwithstanding liberal applications of borax. Such was the case, for instance, in the Green Bay area in 1942 after 50 lb. per acre applications, and in the Racine-Kenosha district in 1943, where the disease affected up to 25 per cent. of the roots after treatment of the soil with 75 lb. borax, broadcast with the 3–12–12 fertilizer (1,500 lb. per acre) and thoroughly worked in before planting. No attempt is made in this paper to explain the inadequacy of borax in the cases under investigation.

Plant virus diseases and their control. Transactions of the conference on plant virus diseases, Moscow, 4-7/II 1940.—340 pp., 68 figs., 3 diags., 10 graphs, 2 maps, Moscow-Leningrad, Acad. Sci. U.S.S.R., 1941. [Received February, 1944.]

This account of the conference on plant virus diseases held in Moscow during February, 1940, contains the following interesting reports.

B. L. Issachenko (pp. 7–9) advocates the training of greater numbers of virus research workers and the establishment of a special virus research centre, preferably as part of the Academy of Sciences.

M. S. Dounin (pp. 22–35) states that at the present moment virus research work in the U.S.S.R. is concentrated in the Plant Virus Laboratory of the Microbiological Institute of the Academy of Sciences and in the Virological Laboratory of the Institute for Plant Protection. In addition, several virus specialists are working at a number of provincial institutes for various crops and at agricultural experiment stations.

M. I. Goldin (pp. 36–48) examined crystalline inclusions in the tissue of living tomato plants infected with the virus of tobacco mosaic [*R.A.M.*, xxi, p. 473] by means of a special apparatus [which is described] and found that the inclusions remained unchanged for an indefinite period. Calculations based on the weight of crystals per unit of leaf space showed that a considerable proportion of the virus material present in the infected plant is contained in the crystals. Observations on the hairs of young tomato plants infected with the virus of tomato aucuba mosaic [ibid., xxi, p. 169] showed that four types of inclusions are typical of that virus, all four being fundamentally identical: X-bodies which are composed of a bunch of small fibrillar nets; small fibrillar nets; Ivanowski's crystals of a polymorphic type which are formed either from X-bodies or independently of them; and long fibrillar threads or needles (Smith's spike crystals). It is suggested that the presence of crystalline inclusions and their type can be used as criteria in the identification of virus diseases.

K. S. Souchov (pp. 68–81) sums up the available knowledge on 'zakooklivanie' [pseudo-rosette: see below, p. 211; ibid., xxi, p. 9] of cereals, and states that an important factor in limiting the activity of the vector, *Delphax* [*Delphacodes*] *striatella*, is the parasitism of *Pristogenetopus conjunctus*. In 1939, 2 to 4 per cent. of the hibernating generation of the vector was infected by this parasite and 18 to 25 per cent. of its first summer generation. Another enemy of the vector is the larva of a ladybird which was observed to destroy great numbers. Pseudo-rosette occurs in the Far Eastern region, in Eastern and Western Siberia, the Karaganda, and the Kirov and Voronezh districts of European U.S.S.R.

A. M. Vovk (pp. 82–106) reports on the effects of mulching and watering on pseudo-rosette disease of oats observed in 1939. Oats grown in plots with 200 plants per sq. m. had 77·6 per cent. total infection (33·8 per cent. showed the milder symptoms of mosaic) when mulched with white paper, 100 per cent. when mulched with peat or left unmulched as a control (both these series also showed a predominance of the severe type of symptom, stunting), and 99·8 per cent. (97 per cent.

stunting) when watered twice during the growing season. Measurements of the soil temperature in these plots at depths of 6, 10, 18, and 25 cm. showed that it had no effect on the disease. Counts of the first generation of *D. striatella* (which is the generation mainly responsible for the spread of the disease) showed that fewer insects were present in plots with white mulching paper (57 insects per sq. m.) than in the control plots, plots mulched with peat, or those watered, which had 206, 161, and 146 insects per sq. m., respectively. Similarly, in plots with 90 plants per sq. m., the corresponding figures were 50, 129, 69, and 98 insects, respectively. When, however, the insects were forcibly introduced into the plots protected from all sides to prevent escape, plots with white mulching paper had 98·6 per cent. infection as compared with 77·8 in the control exposed to free visitation by the vectors, demonstrating the predominant importance of the insect in the incidence of the disease. The exact nature of the obviously repellent action of the white mulching paper on the vector is as yet unknown. It is worthy of mention that plants grown on white or black mulching paper, whether healthy or diseased, were more vigorous than the controls, grew higher, formed more branches, gave larger yields, and were more drought-resistant. In studies with other cereals conducted in 1939 in Omsk pseudo-rosette disease was transmitted by means of non-sterile larvae of *D. striatella* from wheat to oats, rye, wheat × couch grass hybrids, maize, and barley; and from oats to wheat, rye, wheat × *Agropyron* hybrids, maize, barley, millet, and sorghum. The incubation period on all hosts was eight to ten days. Pseudo-rosette disease did not cause in wheat, rye, and wheat × couch grass hybrids the greening of inflorescences and excessive branching found in oats. It is considered as proved that the mosaic disease of wheat in the Omsk district is identical with pseudo-rosette. During 1939, less susceptible varieties of spring wheat suffered in the field 10 to 25 per cent. infection, and the more susceptible 20 to 50 per cent.; barley showed 30 to 40 per cent. infection; the percentages of infection were even higher in nurseries. Rye, both in the field and in nurseries, had only 0 to 2 per cent. infection, and millet up to 6 per cent. Denser sowing was again shown to reduce the incidence of disease: barley sown at the rate of 120 kg. per ha. had 60 per cent., and at the rate of 170 kg. only 30 per cent. infection. Winter wheat was less infected in the Omsk district when sown in the last ten days of August than when sown earlier; such disease as occurred was apparently due to infection next spring. None of the wheat or barley varieties tested was immune from the disease; the most resistant were the wheat varieties Lutescens 0956, Smena 01021, Caesium 0111, Leucurum 05383, and the hybrid 94/14530 (cross of Caesium with Dicoccum), with infection ranging from 11·9 to 25 per cent., and the barley varieties Nutans, Nutans 061162, Nudihas-hax, and Pallidum A-4127, A-4271, and A-4270, with from 10·3 to 28·1 per cent. infection. Rye proved generally very resistant, while wheat × rye hybrids were very susceptible. Wheat × *Agropyron* hybrids showed little susceptibility in the F_1 to F_3 populations, but later both resistant and susceptible types occurred.

S. D. Grebennikov (pp. 107–119) proposes the name pseudo-rosette for the disease of oats previously described as 'zakooklivanie'. The results of a study conducted in Siberia from 1934 to 1939 showed that the disease is not transmitted through the seed. Its development is favoured by excessive soil moisture during the early stages of plant growth, and often coincides with an increased activity by the larvae of Elateridae. Vernalization reduced the percentage of disease in the oats varieties Victory and Gold Rain from 62·3 to 12·5, and from 68·5 to 16·8, respectively, in 1939; and from 12·8 to 4·4 and 13·2 to 5·2, respectively, in 1937. In fertilizer trials at Omsk in 1937 the addition of phosphorus to the soil decreased the percentage of diseased plants to between 2 and 4, and that of nitrogen increased it to between 28 and 33 as compared with 13 to 15 per cent. in the unfertilized control. The author's observations led him to believe that there is no

definite correlation between the date of sowing and the incidence of the disease. The latter depends mainly on high humidity of the soil and air combined with low temperature at certain phases of plant growth, and may, therefore, vary from year to year and from locality to locality. The percentage of diseased plants was much decreased by loosening the soil between rows of oats by either ploughing (from 18·4 per cent. to 3·8) or hoeing (from 24·6 to 4·8), once after emergence and again before tillering. Other factors having a limiting effect on the disease are deep sowing (5 to 8 cm.) on light soils, the cutting and destruction of weeds, and the burning of stubble in the autumn followed by deep ploughing. In crop rotation, potato, fallow, onion, and poppy encourage subsequent disease development in oats, while pulse is unfavourable to it. To demonstrate the importance of certain agrotechnical practices two parallel experiments were conducted; in the first only large seed, selected by hand and vernalized, was sown at the rate of 2 zentner [100 kg.] per ha. at a depth of 6 to 8 cm. in rows 8 to 10 cm. apart, while the field received after emergence 30 kg. each of potash and superphosphate and was cultivated after fertilization and again during tillering; in the second, non-selected, non-vernalized seed was sown at the rate of 0·8 zentner [40 kg.] per ha. at a depth of 3 to 4 cm. in rows 28 to 30 cm. apart, and the plots received no fertilizer and were not hoed or cultivated. The percentage of diseased plants in the first plot was 1·2 as against 24·2 in the second. The cultivation outlined for the first plot is recommended as a basis for the control of the disease.

Mme V. A. Bruizgalova (pp. 120–132) states that in experiments conducted near the Baikal Lake, Eastern Siberia, pseudo-rosette of oats was transmitted by sterile *D. striatella* individuals to wheat, producing 41·6 to 80 per cent. infection and causing the formation of deformed, whitish, sterile ears. This symptom is locally known as 'curl', and the result of the experiment is taken to have established the identity of this disease with pseudo-rosette. Artificial infection of oats in the early stages of growth (coleoptile, first, and second leaves) gave 17 to 26 per cent. severely dwarfed plants, at the beginning of tillering 16 per cent. dwarfs, at the stage preceding heading 1 to 2·5 per cent. infected plants with only mild symptoms, and at the heading stage no sign of infection whatsoever. Oats sown on a plot receiving the normal amount of sun developed 8·6 per cent. dwarfed plants with either proliferated heads or none at all, while those grown on a completely shaded plot, though showing 13·7 per cent. infection, had an almost normal appearance and only proliferated ovaries and deformed grains. Counts of *D. striatella* throughout the season of 1939 showed that 415 to 472 insects per standard sample were present over oats fields, 258 over adjacent pasture land, 7 to 32 over wheat fields, and only single individuals over fields of winter rye, American couch grass [*Agropyron repens*], or pastures more than 500 m. distant from oats fields. Eggs of the first population of the insect were found primarily in oats plants (47 to 63 per cent. plants in one field); of the weeds encountered in oats fields, *A. repens* harboured eggs, but the percentage of infected plants of this species did not exceed 12. Eggs of the second generation were found primarily on *Setaria viridis* (on 66 per cent.) and *Galeopsis tetrahit* (on 54 per cent.); on steppe land an abundance of eggs was also found on *Scutellaria scordiifolia*. In crop-rotation experiments oats following oats had 19·8 and 8·7 per cent. infection on high and low ground, respectively, while oats following summer rye or wheat (both on high ground) had 4·8 and 5·3 per cent., respectively. In years favouring a high incidence of the disease oats sown after 25th May showed less infection than those sown earlier. Oats stands with 610 plants per sq. m. showed in 1938 14·2±1·4 per cent. infection as compared with 35·4±2·7 in those with 312 plants; similar results were obtained in 1936 and 1939. This consistently higher incidence of disease in thinner stands is believed to be partly due to the greater number of vectors present and partly to the greater amount of light.

S. V. Petrukovich (pp. 133–139) reports that pseudo-rosette of oats was observed for the first time in the Kirov district in 1938, where it represents the most serious disease of that crop, causing up to 20 per cent. infection in the field and up to 80 per cent. in experimental plots. None of the oats varieties tested showed any consistent resistance to the disease.

S. S. Khairullin (pp. 140–144) records that pseudo-rosette of oats causes up to 65 per cent. infection (or an average of 37 per cent. for five years) in the Transbaikal district of Eastern Siberia. The prevalence of the disease is stated to vary largely from year to year, and in any one year from one locality to another. Barley was attacked to the extent of 60·2 per cent. in 1936. All varieties of oats and barley tested proved more or less susceptible to the disease; the most promising strains of oats belonged to the *volgensis* group, and of barley to the forms from Abyssinia and Eritrea (var. *deficiens*). Other tests confirmed the results obtained elsewhere with regard to the higher incidence of disease in thinner stands and lower sites. The incidence was found to be higher on badly cultivated land and on heavy soils than on well-ploughed land and on sandy soil.

L. F. Russakov (pp. 145–152) gives the available data on the incidence of certain virus diseases of crops. Pseudo-rosette was particularly severe during 1939 and most prevalent in the forest-steppe and steppe zones of Western Siberia, where the oats variety Gold Rain suffered between 66 and 99 per cent. infection; the disease was less severe in Eastern Siberia and almost absent from the European U.S.S.R. Wheat and barley were attacked to a lesser degree. None of the oats varieties tested was resistant to pseudo-rosette, but some were considerably less susceptible than others, varying, however, in their reaction according to the district. Generally, early-ripening oat varieties seemed to be more susceptible than the late-ripening. Bean varieties differed greatly in their resistance to mosaic [ibid., xi, p. 417], the least susceptible being Tepary from Arizona.

V. K. Zazhurilo and Mme G. M. Sitnikova (pp. 153–164) state that reductions in yield of winter and summer wheat and oats caused by mosaic [ibid., xxii, p. 59], as measured on individual plants in the field, amount to between 40 and 100 per cent. the weight of grain. It is considered that mosaic is more closely related to pseudo-rosette than to any other virus disease of cereals, but differs from it in producing no protein crystals in plant cells, having no proliferation or masked mosaic symptoms, a different species of vector, and a longer incubation period. It is considered that the virus of winter wheat mosaic, as it is proposed that it should be known, is new to science. Five years' observations in the Voronezh district showed that winter wheat mosaic is capable of infecting *Setaria glauca*, *S. viridis*, and, very slightly, *Calamagrostis epigeios*. Density of stand was found to influence the incidence of mosaic. Thus, 6·2 per cent. infection occurred in oats continuously sown at the standard rate as against 64 per cent. in oats sown in rows at a lower rate. Winter wheat (Hostianum 0237) sown at the rate of 140 to 160 kg. per ha. showed 7·8 per cent. infection as against 14 per cent. when sown at the rate of 30 kg., and 22 per cent. when sown at the rate of 15 kg. Early sowing dates are recommended for summer crops and later ones for winter wheat. Of the three populations of the vector, *Deltocephalus striatus*, which commonly develop during a season, only the third, the autumn one, is of importance in the infection of winter crops, while the first is responsible for the infection of summer crops. Mass infection in the spring occurs when early hatching of the insects coincides with an early phase of plant development.

S. N. Moskovets (pp. 173–190) considers that the virus disease of cotton in Azerbaijan [ibid., xvii, p. 392] is not identical with leaf curl occurring in the Sudan. Local symptoms do not include the protruding nervature or the cup-like outgrowths on the lower side of leaves characteristic of the Sudan disease; the sap of healthy plants is pink and that of diseased ones light brown as against reddish-blue and

bright green, respectively, in the Sudan; the vectors are different in the two countries and so are varieties showing resistance to the disease. To avoid confusion of the two diseases it is proposed to name that in Azerbaijan 'cotton curliness'. The disease is stated to have been steadily increasing since its discovery in 1934. In one test the disease caused a reduction of 55 per cent. in the number of bolls formed; in another a reduction of 72·9 per cent. was caused when infection occurred early in the season, the percentage gradually falling to 35·5 with progressively later dates of infection. The number of bolls formed on plants with severe, medium, and slight infection was by 60, 30·7, and 12 per cent., respectively, smaller than that on a healthy one. The susceptibility to cotton curliness varied from variety to variety, the average reduction in yield ranging from 16·2 to 55·6 per cent., and within a variety from one locality to another. It is estimated that in years with severe infection susceptible varieties may suffer losses in yield up to 9·5 per cent. The disease also affects the quality of the cotton fibre, reducing its length by about 7·5 per cent. and lessening its absolute strength by from 3·3 to 16·6 per cent. for different varieties. The average absolute weight of seeds from diseased plants was 11·2 per cent. lower than that from healthy ones. The virus from cotton was successfully transmitted by *Aphis gossypii* or by infusing infected sap into decapitated stems of healthy plants to *Gossypium barbadense* and its variety *maritima*, and to *G. hirsutum*; similar symptoms were produced on *Hibiscus cannabinus* and *Solanum dulcamara*. Three years' experimental data showed that under local conditions *A. gossypii* is the most important vector (85 to 100 per cent. successful transmissions), *A. laburni* (6·1 to 16·6 per cent.), *Myzus persicae* (12·5 to 25 per cent.), and *Epitetranychus althaeae* (7·7 to 10 per cent.) playing a secondary part. The incubation period of the virus varied from 35 to 56 days. In field tests conducted for four years and under experimental conditions with isolation from insects, evidence pointed to the possibility of seed transmission. When cotton was sown in strips of three, four, or five rows each, with a distance of 140 cm. between the strips, the infection percentages were 3·2, 2·9, and 2·7, respectively, substantiating the previous conclusion that less disease occurs in denser stands. The average percentages of infection were 15·5, 19·8, 54·8, and 88·8 following sowings in April, May, June, and July, respectively, the higher incidence in the summer-sown plants being at least partly due to higher temperatures of soil and air. Some cotton varieties were resistant to the virus; the most promising among those bred in Azerbaijan are strains of *G. barbadense*, such as Giza 7 and 3782–1 (from Giza 12), and of *G. maritima*, such as Nos. 1, 2, and 7, and among those bred in Russian Central Asia, 6081, No. 15, 263, 4623*a*, and 35–1. For the control of cotton curliness the author suggests the growing of resistant varieties, roguing of infected plants, separate harvesting from healthy and diseased plants to ensure healthy seed for the next year, and control of vectors.

V. L. Ryjkoff and Mme T. P. Ovcharova (pp. 191–196) describe the anatomical changes produced by the virus disease of cotton found in Azerbaijan [see above]. They consist in a thickening of the leaf lamina, the presence of excessive starch in the lamina and petioles, underdeveloped bast fibres in the petioles, and underdeveloped roots, which are poor in starch. The disease is considered to be a special type of yellows, although it lacks the hypertrophy and necrosis of the phloem usual in this group of virus diseases, and produces an unusual hypoplasy of the bast fibres. It differs from the leaf curl disease of cotton in the Sudan in the following points: in Azerbaijan the diseased leaves tend to curl upwards, the palisade parenchyma is more strongly developed than in healthy plants, no additional cylinders are formed in stems and petioles, and the bast fibres are hypoplastic; in the Sudan the diseased leaves mostly curl downwards, the palisade parenchyma is either underdeveloped or not developed at all, and additional cylinders are formed in stems and petioles. It is suggested that the two diseases

are distinct, and it is proposed to name that in Azerbaijan 'leaf roll' and the virus causing it, according to K. M. Smith's classification, *Gossypium* virus 2, Verderevsky.

L. K. KARA-MURZA (pp. 197–202) found in a physiological study of the Azerbaijan virus disease of cotton that the leaves of diseased plants contain less total and albuminous nitrogen and both leaves and petioles have more carbohydrates, particularly starch, than those of healthy plants, the amount of carbohydrates in the reproductive organs and in the stem walls being, on the other hand, smaller; furthermore, the accumulation of dry matter is less intense, and the amount of chlorophyll smaller.

I. P. KHUDYNA (pp. 203–218) has conducted since 1936 an exhaustive study of virus diseases of tobacco and Indian tobacco, as a result of which the 20 types of disease attacking these crops in the U.S.S.R. are classed in the following seven groups: (1) tobacco mosaic, (2) cucumber mosaic, including white pickle, (3) severe etch, (4) ring spot, (5) wet 'montar' or 'stolbur' [tomato big bud virus], (6) leaf curl, and (7) crinkled dwarf (not yet identified). Most of these diseases occur throughout the tobacco-growing regions except leaf curl, which has been observed only in Georgia and the Central Asian Republics, and crinkled dwarf which is apparently restricted to the Krasnodar district. All except big bud decrease the yield and the commercial quality of tobacco; big bud not infrequently increases the yield and the chemical quality of tobacco leaves, but owing to an intensified hygroscopicity these leaves dry badly and easily go mouldy, and are therefore considered unfit for production. It was proved experimentally that neither tobacco mosaic nor big bud, cucumber mosaic, leaf curl, or crinkled dwarf are seed transmitted, whereas white pickle, etch, and, in one test ring spot, were transmitted through seed. Contact of the roots of healthy transplants with chopped leaves infected with tobacco mosaic virus gave 17·8 per cent. infection. It is considered that white pickle, cucumber mosaic, etch, and ring spot are not spread through hands of workers to any considerable extent. Big bud, which in some years infects 50 to 60 per cent. of the crop and causes great losses, is not spread through the seed, soil, or plant remains in the field and is transmitted artificially only through grafting of diseased eyes or petioles on to healthy plants. Its vector, if any, is as yet unknown. The identity of wet 'montar' with 'stolbur' and big bud is considered to be established beyond any doubt. It is most prevalent in years with wet summers and its development is favoured by mulching. The virus of big bud was detected in bindweed [*Convolvulus arvensis*], the presence of which in tobacco plots was found to increase the incidence of disease in the crop. Other hosts of this virus are *Nicotiana rustica*, *N. glutinosa*, and *N. sylvestris*.

In the control of tobacco mosaic it was found necessary to extend the period of exposure of equipment to formalin solution (1 : 25) from one to four days as the virus was inactivated only after this time. The incidence of tobacco mosaic was lowest where tobacco followed cereals in crop rotation, higher where grown for two years, and highest where grown for three or more years in succession. Eradication of diseased plants prior to harvest decreased the incidence of tobacco mosaic by 2·5 to 4 times: but this measure is only recommended where the number of diseased plants in a field does not exceed 1 or 2 per cent., as with higher percentages the resulting thinning of stands would impair the quality of the crop. Treatment of seedlings with 1 per cent. Bordeaux solution reduced the percentage of mosaic-diseased plants at the end of harvesting to 4·3 from 12·25 in the untreated control. This treatment, however, can only be applied in regions with sufficient moisture, as in arid zones it tends to influence transplantation unfavourably.

For the control of those virus diseases which are transmitted through seed, the following heat treatment has been evolved: seeds with an initial moisture content of not more than 6 per cent. are heated in a thermostat, in which the temperature

gradually rises from 30° or 40° to 90° C., for four hours if piled up in a layer of 1 to 2 cm. thickness, or for 7 to 8 hours if put into bags holding 1 kg. each; exposure to the temperature of 85° or 90° must last at least one hour. The incidence of white pickle in plants grown from heated seed ranged from 2·9 to 7·2 per cent. as against 6·3 to 16·5 for the unheated control; the corresponding figures for ring spot and etch (combined) in tobacco were 1 to 2·28 as against 2·1 to 5·2 per cent., and in Indian tobacco 1·9 as against 7·3 per cent. In farm experiments the heat treatment of seeds increased the yield of tobacco by about 15 per cent. and that of Indian tobacco by about 13 per cent.

V. M. Poner (pp. 227–244) found that the length of the incubation period of the virus causing 'stolbur' in tomato varies greatly in different varieties. It is suggested that in the absence of immune varieties a promising line of work is to cross varieties which have long incubation periods with quickly-ripening ones, as progenies from such crosses might be able to escape much of the 'stolbur' injury. *Solanum nigrum*, with a very long incubation period, exhibited a higher degree of resistance to 'stolbur' than tomato. By grafting, the disease was transmitted to potato, causing a gradually increasing chlorosis of the leaves followed by complete necrosis and an upward curling of the leaf laminae; some plants developed aerial tubers with several small leaves sprouting from them, while subterranean tubers were abnormally small and often deformed. The virulence of the virus in the tomato was found to increase with successive transfers (by grafting) from plant to plant: after the first transfer 20 or 25 per cent. of plants in the plot became infected and the symptoms were very slight, while after the third transfer there was 74·4, and after the eighth 66·6 per cent. infection, with pronounced symptoms in both cases.

Y. M. Reydman (pp. 245–254) reports that during 1939, 50 to 70 or even 90 per cent. of the tomatoes in the Crimea were suffering from 'stolbur'. The losses resulting from this disease depend upon the time of infection, the stage of plant development at that time, and the variety of the host. It was calculated that every 1 per cent. of plants of a moderately quick-ripening variety succumbing to infection before the beginning of September results in a 0·5 per cent. decrease in the general yield of fruits. During 1939 the disease is known to have been prevalent also in the Krasnodar, Eysk, and Frunze districts, and in the Moldavian Autonomous Republic. In the Crimea the intensity of infection varies from year to year and in any one year from locality to locality, according to meteorological conditions. High temperatures of soil and air are generally favourable to the disease. However, when a period of drought is interrupted by abundant rains, 'stolbur' development following these rains is more intense than in completely dry seasons. Similarly, intensified disease development was found to occur after extensive watering of the tomato plants during a hot spell. This is explained by the fact that rains or watering encourage the growth of tender new shoots, on which the symptoms are more marked. Late dates of transplanting insured healthier plants than early ones, as it appears that plants entering the hot period, which is that of infection, when still young, suffer less from the attack than older ones. On the other hand. plants which contrive to set sufficient fruit on the lower trusses before the onset of heat give good yields in spite of infection, whereas plants still undeveloped at that time bear no fruit at all. It is suggested that good yields can be obtained by early planting of quickly-ripening varieties such as Bison, which yields most of its fruit crop before the outbreak of 'stolbur'. In any case, care should be taken to raise vigorous seedlings. Comparative trials showed that the yields of Bison for the whole season (the bulk is ripe before 1st August) were consistently higher than those of the late-maturing Market's Marvel (all but a fraction ripens after 1st August). The planting of shade screens of maize or sorghum between the rows of tomatoes reduced the yield in every instance. This is attributed to the fact that

plants grown as shade screens develop comparatively late and become effective only after the tomato plants have already suffered from the effects of heat. In addition, these plants consume much of the nutritional matter in the soil, depriving the main crop of the benefit of it. Mulching with straw increased the yield by 12 to 45 per cent. and decreased the percentage of 'stolbur' infection as compared with the control. Dense stands, planted 100 × 30 cm., showed larger yields and smaller percentages of 'stolbur' (305 zentner per ha., 26·3 per cent.) than the usual plantings at 100 × 60 cm. (248 zentner per ha., 51·1 per cent.). Watering at night during the hot months gave better yields and less 'stolbur' than watering during the day. Extensive trials and observations have shown that tomatoes of the *validum* group are generally more resistant to 'stolbur' than those of the *esculentum*. Varieties of the former group, such as the late-ripening Stone, are recommended to ensure the supplies of tomatoes in the presence of 'stolbur'.

B. I. Serbinov (pp. 264–268) states that 'stolbur' of tomatoes is one of the most prevalent and serious diseases in the Moldavian Autonomous Republic. In recent years it has been on the increase, affecting 20 to 25 per cent. of plants in the field in 1937, 35 to 40 in 1938, and 50 to 75 in 1939. The disease is favoured by the prevailing weather conditions in the summer: droughts interrupted by infrequent downpours of rain. The disease usually appears during July. Of the control measures tested, mulching reduced the percentage of 'stolbur' infection from 20 to 10 and increased the yield; spraying with 1 to 1·5 per cent. lime solution reduced the infection from 20 to 14·2 per cent., but also depressed the yields; spraying with 1 per cent. Bordeaux mixture reduced the infection from 40·7 to 29, 20 to 14·8, and 66·6 to 46·6 per cent. without harmful effects on yield; planting tomatoes between the rows in an orchard resulted in only a slight amount of 'stolbur' (1 to 9 per cent.); and planting in denser stands than the standard reduced infection from 28 to 17 per cent. and increased the yield. In the field 'stolbur' infection usually follows tobacco mosaic, attacking more severely plants infected with mosaic at early stages of growth than those infected later.

P. I. Dvornikov's (pp. 269–271) observations at the Moldavian Experiment Station showed that tomato plants most liable to become infected by 'stolbur' are those with few leaves and horizontally-grown stems which are very exposed to the sun's rays. The temperature above the soil near the base of such plants is about 70°, whereas near upright-growing plants which provide shade for themselves it was not above 30°. During 1939 it was observed that upright varieties showed only 4 to 6 per cent. 'stolbur', those inclined to lodge but with rich foliage (Market's Marvel, John Baer) 17 to 19 per cent., and those with widely spaced leaves, such as Break-o'-Day and Budennovka, 25 and 34 per cent., respectively. In the 1938 and 1939 tests plots with a nutritional area [per plant] of 100 × 20 cm. had 3·4 and 17 per cent. 'stolbur' as against 17·7 and 41 per cent., respectively, in plots with one of 100 × 70 cm. Earthing-up of tomato bushes (in a 100 × 100 cm. series) resulted in 19·2 per cent. infection as compared with 61·5 in the control plot; covering the base of the plant with white paper (in a 100 × 40 cm. series) gave 8·2 per cent. infection as against 18·2 in the control.

A. I. Serebryakov (pp. 272–277) describes 'stolbur' as the most widely spread and harmful disease of tomato in the southern U.S.S.R. In the Krasnodar region, where it is only moderately prevalent, the disease caused losses of at least 5 tons per ha. Infection coincides with the beginning of the fruiting stage of the host plant. In the Krasnodar and Rostov regions four different types of 'stolbur' expression were observed: (1) the leaves are characteristically elongated and small, new shoots later become blue-violet, often with a yellow tinge, no fruit or only a few orange-coloured ones are formed, and the plants dry off long before the end of the vegetative period; (2) leaves show throughout the season a mosaic pattern without change of colour, a few fruits are formed, sometimes proliferation of

branches occurs, and the plants dry off only at the end of the season at the same time as healthy ones; (3) a rare form is characterized by a twisting of the stem of 180°, drooping and spiral twisting of leaves, giving the plant a 'weeping' appearance, and a mosaic type of colouring of the whole plant; and (4) plants have the mosaic colouring without pronounced proliferation of branches, but all trusses are very branched and bear many undeveloped buds. Seeds harvested from 'stolbur'-infected plants were very flat with only about 20 per cent. germination, giving rise to very weak, but otherwise normal seedlings; the subsequent development of 'stolbur' in these seedlings did not differ significantly from that in other plots, indicating that the disease, though inducing very poor-quality seed, is not seed-transmitted. Of the various tomato varieties tested those belonging to the *validum* group (bushy forms) showed most resistance to 'stolbur': in 1939 Kuban (hybrid 252) showed 14 to 19 per cent. infection as compared with 50 to 80 per cent. in the Break-o'-Day, Marglobe, and Juwel 4.

Mme O. N. Vertogradova (pp. 278–285) reports that a survey of 18 farms in the Saratov region during 1937 revealed 'stolbur' to be present in all, affecting 2·2 to 68·1 per cent. (usually 20 to 60 per cent.) of tomato plants, generally with a medium degree of severity, although severe infection was detected in 17·6 to 30 per cent. In the Stalingrad region 'stolbur' was also generally present, affecting 14·5 to 89 per cent. of the plants (usually 40 to 89 per cent.), the prevalent degree of infection being medium and severe. In the [former] Republic of Volga Germans 'stolbur' was almost universally present, with 5 to 70 per cent. infection and a medium degree of severity. Experiments in the Saratov district showed that a loss of 97 per cent. of the yield corresponds to the severe degree of infection, one of 64·4 to the medium, and one of 17·3 to the slight. Losses amounting to 61·08 per cent. of the yield occurred on a farm with 68·1 per cent. infection. The percentage of woody fruits in the variety Budennovka, which had shown 45 per cent. infection, amounted to 12·18. In the Stalingrad district up to 60 per cent. of the harvested fruits were diseased. A planting of the variety Budennovka with 62 per cent. infection yielded 37·83 per cent. woody fruits. Observations in the lower Volga region lend no support to the opinion of workers elsewhere that 'stolbur' is connected with poor water supply, as plantings situated in moist localities were found to be severely affected, while some in the dry steppe were almost free from disease; where watering was applied, 'stolbur' developed most severely in the wake of the sprayer; and finally, healthy or only slightly affected plants were found growing on high-lying fields receiving no watering. In monoculture, tomatoes suffered more from 'stolbur' than in crop rotation. In varietal trials the highest resistance (from 1 to 5 per cent. infection only) was displayed by the bushy varieties Alpatyeva and Planovoy, Best of All, John Baer, and Hybrid 252. Aucuba mosaic of tomato was found on only one farm in the Stalingrad district.

Mme E. V. Shatova (pp. 286–293) gives the results of chemical tests in the control of tobacco mosaic conducted during 1939 at the Virus Laboratory of the Pan-Soviet Institute of Plant Protection. Complete inactivation of the virus *in vitro* was accomplished by adding 1 per cent. Bordeaux mixture to the sap of mosaic-diseased leaves of Trapezond 703 tobacco (in proportions 1 to 1 or 1 to 2) and storing the mixture for 2 hours at a temperature of 20° to 22°. Similar treatment of the diseased sap with 2 per cent. lime-sulphur or 1 per cent. barium fluosilicate gave only partial inactivation. The same three chemicals were used for spraying tomatoes as a means of protection against mechanical infection. seedlings were sprayed the day before the first transplantation (in the greenhouse) and then artificially infected with the virus of tobacco mosaic by pressing first a diseased leaf between two fingers and then healthy ones, wounding only the hairs. After 21 days seedlings sprayed with (1) barium fluosilicate showed 77 per cent. mosaic, (2) lime-sulphur, 79 per cent., and (3) Bordeaux mixture 89 per cent.,

while unsprayed infected seedlings had 97·4 per cent. The same day healthy plants of all series (and other healthy ones of the same age to make up the numbers) were planted out into the open after being again sprayed and infected as before: 12 days later series (1), (2), and (3) showed 79·4, 75·6, and 81·4 per cent. healthy plants, respectively, as against 11·1 per cent. in the unsprayed infected control. The lower percentage of healthy plants in series (1) is ascribed to the difficulty of spraying seedlings in flats thoroughly. The yields of the three sprayed series and of the unsprayed infected control were 91·8, 82·9, 77·2, and 43·9 per cent., respectively, of the unsprayed healthy control. In experiments with tomato and tobacco workers first touched a diseased leaf and then submerged their hands in a solution of one of the three above-mentioned chemicals for 5 to 10 seconds before transplanting each plant; in the control series, the hands were washed in water. As a result, 100 per cent. of tobacco and 96 of tomato seedlings in the control series became infected as against 18, 22, and 16 per cent., respectively, in the three disinfectant series with tobacco, and 30, 34, and 20 per cent., respectively, with tomato. None of the chemicals was harmful to the skin; a slight yellow discoloration produced by lime-sulphur disappeared after two thorough washes. It was noticed that diseased tomato plants in the three series in which chemicals were used, although exhibiting mosaic symptoms, developed almost as well as healthy ones.

E. M. Eristavi (pp. 294–308) gives a list of virus diseases recorded on 39 genera of plants in Georgia during 1939; new records are a ring-spot type of disease on *Phaseolus multiflorus*, pea mosaic, a rosette disease of groundnut (resembling that caused by *Arachis* virus 1), a mosaic of *Pistacia mustica*, spotted wilt of tomato (causing up to 58·17 per cent. infection and inflicting serious losses), streak and aucuba mosaic on tomato, 'stolbur' on chilli (up to 50 per cent. infection), and mosaic of *Physalis alkekengi*, *Solanum persicum*, *Hyoscyamus niger*, *Petunia* sp., and *Datura stramonium*, which also showed a necrotic ring spot of *Lycopersicum* virus 3 type.

Mme A. Sladkomedova (pp. 309–315) describes a new disease of potato, of unknown origin, in the Kharkov region, where it has been on the increase since 1935 (the percentage of infection rose from 6·1 in 1936 to 62·6 in 1939). The most stable symptom of the disease is the round shape of the leaves; the diseased plants are usually dwarfed and later in the season the leaves become slightly wrinkled; the tubers set abnormally late if at all and remain very small. Sometimes the symptoms are restricted to one part, usually the top, of the plant. Frequently, the symptoms become masked and the plant acquires a normal appearance. The yield of diseased plants is reduced by from 53 to 91·3 per cent. that of the healthy. The disease was found to be transmitted through mother tubers. No fungi or bacteria were associated with the disease.

Mme A. N. Mamontova (pp. 316–320) successfully applied the serological method for the identification of leaf roll of potato in seed material. In the resting tuber the virus was found to be concentrated in the centre, mainly in the youngest part of the tuber; in the sprouting tuber the virus is evenly distributed throughout.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lv, 1, pp. 16–20, 6 figs., 1944.

In New South Wales the most serious seed-borne tomato disease is bacterial canker (*Aplanobacter* [*Corynebacterium*] *michiganense*) [*R.A.M.*, xxii, pp. 11, 420]. All commercial varieties are susceptible, and losses of 80 per cent. or more are often experienced in crops grown from infected seed. As the organism can live over in the soil and will infect the crop planted in the following season, losses may be very heavy indeed. Seed should be saved only from crops free from the disease. Seed which, it is thought, may be carrying infection, should be soaked for 24 hours

in 0·6 per cent. acetic acid and thoroughly dried. This treatment can be effected at any time before sowing. It does not impair germination or keeping quality. Affected crop refuse should be collected and burnt, and the land should not be planted to tomatoes again for at least three years. The site of the seed-beds should be changed annually.

Oats are affected locally both by loose smut (*Ustilago avenae*) and covered smut (*U. levis*) [*U. kolleri*], while intermediate types and distinct strains of these fungi are also present [*R.A.M.*, xxi, p. 124]. Locally, loose smut is the most common form of the disease. The Lampton variety is highly resistant to smut, while the Belar, Buddah, Gidgee, Guyra, Mulga, and Sunrise varieties are moderately resistant, and the Algerian, Burke, Fulghum, and White Tartarian are susceptible. Seed of susceptible and moderately susceptible varieties not obtained from crops known to be free from smut should be treated with agrosan or ceresan dust (2 oz. per bush.).

Osborn (E. M.). **On the occurrence of antibacterial substances in green plants.**—*Brit. J. exp. Path.*, xxix, pp. 227–231, 1943.

Of approximately 2,300 species of plants belonging to 166 families tested against *Staphylococcus aureus* and *Bacterium coli*, 63 genera belonging to 28 families were found to contain substances inhibitive to the growth of one or both test organisms. Only two plants were specific against *Bact. coli*. Extracts from plants of the same family showed a similar specificity and potency, suggesting that similar types of anti-bacterial substances occur throughout the family. The active substances were in some cases distributed throughout the plant, and in others restricted to one part of it. Drying resulted in a loss of inhibitory power in some plants, while in others it was still active after a year. Certain well-known drug plants, such as *Atropa*, *Datura*, and *Digitalis*, showed no inhibitory power under conditions of this experiment.

Levine (M.). **Formative influence of carcinogenic substances.**—*Cold Harb. Symp. quant. Biol.*, x, pp. 70–78, 1942.

Included in this critical survey of the literature on the carcinogenic action of chemical substances are references to the development of crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) in plants in response to the application, e.g., of coal tar and scarlet red and other azo compounds. A number of the studies under discussion have been noticed in this *Review* from time to time. The results to date of the experiments on plants are interpreted as indicating that tumour formation is a function of the host rather than an effect of the chemical applied. The slight overgrowths induced by some carcinogens are somewhat analogous to benign growths, but more closely resemble the protective scar tissues or granulomata of man and animals [cf. *R.A.M.*, xxiii, p. 8].

Riceman (D. S.) & Anderson (A. J.). **The symptoms and effects of copper deficiency in cereals and pasture plants in South Australia.**—*J. Dep. Agric. S. Aust.*, xlvii, 2, pp. 64–72, 13 figs., 1943.

Full descriptions are given of the effects of copper deficiency on cereals and grasses in South Australia [cf. *R.A.M.*, xxiii, p. 148]. Wither-tip, the severe form on oats, appears during hot weather in September. The leaves are limp, and the young shoots and leaf tips wither and turn white, at the same time being sharply reflexed. The last-formed leaves are primarily affected, but in severe cases all the leaves show the condition. The margins commonly show a pale green or yellow colour. Severely affected plants rarely produce heads. New tillers appear throughout the season, and an affected crop may remain green and produce tillers long after normal crops have ripened off, these secondary tillers also developing wither-tip. If produced, the heads are white and empty. A milder form occurs in which

wither-tip lesions develop on some leaves only, and pale margins are less common. The normal number of heads may be produced, but these are white and empty, or very poorly filled. There is some secondary tiller formation. In addition, oats are widely affected by an obscure form of copper deficiency in the south-eastern areas, in which the condition may be detected only by experimental means.

A comparison of severely affected wheat and oat plants shows that wheat usually suffers more severely than oats, developing a progressive die-back of the leaves and shoots, without secondary tillering. Wither-tip is not found in wheat. The affected parts of the wheat leaf turn brown. The sharp collapse of the leaf observed in wheat is not found in oats. In wheat, the older leaves are affected first. Barley appears to be less susceptible than oats. The leaf lesions are similar to those on oats, but are less pronounced, and there is more yellowing and less bleaching. No continued or excessive tillering occurs, and badly affected plants die before reaching maturity. Rye has shown no reponse to copper treatments locally, and has given a satisfactory crop without treatment, even in affected areas. No disease symptoms were observed in the field. Copper deficiency symptoms are seldom seen on plants comprising the natural pastures on soils very deficient in copper, but susceptible species are unable to compete with resistant types.

When copper deficiency is suspected, simple trials with copper-superphosphate mixtures should be made. Tests should also be carried out to ascertain the most productive varieties for each affected area. In the coastal sandy areas seriously deficient in copper and zinc, simple top-dressing of the natural grasses with copper-zinc superphosphate is unlikely to produce any response; in these localities, suitable species must be sown with the superphosphate mixture.

RICEMAN (D. S.) & ANDERSON (A. J.). **Copper and zinc deficiency in pasture and crops in South Australia.**—*J. Dep. Agric. S. Aust.*, xlvii, 1, pp. 16–29, 15 figs., 1 map, 1943.

In this paper the authors discuss the widespread distribution of copper and zinc deficiency in South Australian soils [see preceding abstract] and make recommendations, based on seven years' experiments, for appropriate and effective treatment which will enable good cereal crops to be grown and permit the establishment of sown pastures and lucerne.

Most of the area concerned is only slightly affected. Direct trials on indicator cereals, such as oats or wheat, offer a simple method of detection of deficiencies, and growers are advised to carry out their own trials by sowing a long drill-row in the usual manner with superphosphate containing 14 lb. copper sulphate per bag, and comparing the effect on the grain yield from this strip with the yield from an adjacent strip sown with superphosphate only. Similar sowings of different legumes with and without zinc and copper will indicate the presence or absence of the deficiency and show what species is best adapted to the environment.

WHITE (N. H.). **Physiological studies on the fungus Ophiobolus graminis Sacc. 2. Carbon and nitrogen requirements.**—*J. Coun. sci. industr. Res. Aust.*, xvi, 4, pp. 234–244, 2 graphs, 1943.

Further studies on *Ophiobolus graminis* [*R.A.M.*, xx, p. 522] demonstrated that it can utilize a wide range of compounds as sources of carbon and nitrogen for respiration (estimated as oxygen uptake) and assimilation (dry weight of mycelium after ten days' growth). Assimilation was greatest with carbon as carbohydrates and nitrogen as asparagin or peptone. Some compounds which gave poor assimilation were good respiratory substrates. Differences were found in the assimilability of compounds, and when carbon and nitrogen were present in optimal amounts these differences were due to anabolite efficiency values of the compounds, which conditioned the growth rate rather than the maximal amount of growth of

the fungus. This was the third factor (the other two, biotin and thiamin, being found in the earlier work) conditioning growth in synthetic solutions. The efficiency values were optimal for growth when nitrogen was supplied as a mixture of amino acids or peptone and carbon as glucose at optimal concentration.

The optimal concentration for nitrogen, as potassium nitrate, ammonium nitrate, glycine, or asparagin, was 200 mg. per l., when the carbon source was equivalent to 2 per cent. glucose, while the concentrations were 200 mg. per l. and 1 per cent. when nitrogen was supplied as a mixture of amino acids or peptone.

The growth phases on all forms of nitrogen resembled those of bacteria, and induced characteristic changes in the substrate.

Ammonia was produced in the substrate when organic nitrogen compounds were the sole source of carbon for respiration and assimilation, and again during the autocatalytic phase of growth. In both cases ammonia production appeared to be due to deamination processes.

DASTUR (J. F.). **Notes on some fungi isolated from 'black point' affected Wheat kernels in the Central Provinces.**—*Indian J. agric. Sci.*, xii, 5, pp. 731–742, 1 pl., 8 figs., 1942.

The following fungi were isolated from wheat kernels affected by 'black point' in the Central Provinces [*R.A.M.*, xv, p. 433]: *Cochliobolus tritici* n.sp., *Helminthosporium* spp. A and B, *Pseudophoma* sp., *Nigrospora sphaerica*, *Rhizoctonia* sp., and *Sclerotium rolfsii*.

C. tritici is characterized by scattered or gregarious, brownish to black, pseudoparenchymatous flask-shaped perithecia, 220 to 597 by 172 to 406 μ, with or without cylindrical, ostiolar beaks, 53 to 236 by 53 to 124 μ ; cylindrical or clavate, straight or slightly curved, shortly stipitate or sessile, hyaline, thin-walled asci, 80 to 228 by 13 to 34 μ, containing eight helicoid, flagelliform or filiform, 4- to 12-septate, hyaline spores, obtusely pointed at the apex and tapering towards the base, 125·4 to 301·6 by 3·8 to 7·6 μ; numerous hyaline, septate, sometimes dichotomously branched paraphyses, 1·6 μ in width; and straight to slightly curved elliptical, 5- to 9-septate conidia, with broadly rounded ends, firm, light brown to honey-coloured walls, and a basal scar, 45·6 to 83·6 by 11·4 to 15·2 μ.

H. A produced two kinds of conidiophores, one arising directly from the mycelium in the cells of the host tissue, and the other from the thin layer of aerial mycelium on the exterior of the pericarp. In the former type the base is swollen or bulbous, while in the latter the conidiophore is a prolongation of a hyphal branch, and its inception is marked by a slight thickening and colouring of the terminal cell of the hypha. The 3- to 6-septate conidiophores borne on the pericarp measure 41 to 243 μ up to the first scar and their bulbous ends 5·5 to 11 μ in width. The development of the obpiriform, obovate spearhead-shaped, or elongated-elliptical, straight but sometimes compressed and distorted, 3- to 7-septate, dark brown or honey-coloured, basally pale or hyaline conidia, 45·6 to 91 by 18·7 to 30 (average 52 to 78 by 18·7 to 30·4) μ, is typical of the genus.

H. B is characterized by a very sparse production of conidiophores and conidia. The former are simple, light to dark honey-coloured, 3- to 5-septate and measure 23 to 53·2 by 2 to 3·5 μ up to the first scar, and the latter, numbering two to six on each conidiophore, which they resemble in colour, are elliptical, uniformly triseptate, 18·75 to 30 by 7·5 to 11·25 μ.

P. sp. produces subepidermal, coriaceous to carbonaceous, piriform or subglobose perithecia, provided with a short ostiolate beak, 152 to 228 by 38 to 53 μ; and hyaline, ellipitical or ovoid, unicellular conidia, 5 to 6·7 by 1·7 to 3 μ, escaping through the ostiole in long tendrils.

Inoculation experiments with *C. tritici*, the two *H.* spp., *P.* sp., and *S. rolfsii* gave positive results.

In the few cases in which the kernels yielded more than one organism, the mixtures included *Aspergillus*, *Penicillium*, *Mucor*, *Fusarium*, *Chaetomium*, *Alternaria*, and *Cladosporium* spp., singly or combined.

HUMPHREY (H. B.) & DUFRÉNOY (J.). **Host-parasite relationship between the Oat plant (Avena spp.) and crown rust (Puccinia coronata).**—*Phyptopathology*, xxxiv, 1, pp. 21–40, 6 figs., 1944.

In November and December, 1942, and in January and February, 1943, oats seedlings of the Bond, Victoria, Rainbow, Markton, Richland, and Bond × D 69 seedlings were inoculated in the greenhouse at Louisiana State University with the uredospores of physiologic race 1 of *Puccinia coronata*, originating at Beltsville, Maryland. The establishment of the parasitic relationship between the leaf cells of the host and the invading hyphae of the rust was shown to depend on the release of phosphorus compounds by the former for the utilization of the latter. Cytochemical examination of the affected tissues revealed changes that are interpreted as secretion phenomena and appear to correspond with those proceeding in either plant or animal cells in response to the physical, chemical, or pathological stimulus of a parasite or other pathogenic agent. The excretion of phosphorus into the intercellular spaces by cells which would normally retain this element intact is accompanied by an internal secretion within the vacuolar solution, resulting in the 'coacervation' [*R.A.M.*, xxi, p. 536] of phenolic compounds, especially pyridoxin. These indophenol blue-forming phenolic compounds are most abundant in the vacuoles of the guard cells and of the long epidermal cells in line with the stomata. The 'coacervation' of phenolic compounds appears to be correlated with the dispersion of the nucleotids or phosphoproteids in the cell and with the resultant decompensation of respiration. The latter process may assume varying degrees of severity, a mild form permitting the survival of the host cells, while severe damage rapidly proves lethal to the plant, which reacts by the development of the necrotic lesions characteristic of hypersensibility.

WEBBER (H. J.). **A doença da 'tristeza' do porta-enxerto de Laranjeira azeda.** [The 'root rot' of Bitter Orange stocks.]—*Biológico*, ix, 10, pp. 345–355, 1943.

The author traces the history of the form of root rot known as 'tristeza' affecting sweet oranges and other species of citrus grafted on bitter orange stocks, and critically discusses the various theories advanced in explanation of the disease, which was first recognized in South Africa about 1910 and subsequently reported from Java (1928), Argentina (1931 or thereabouts) [*R.A.M.*, xx, p. 400; xxi, p. 485], and Brazil (1937). In the last-named country it has been studied by S. Moreira (*Biológico*, viii, pp. 269–272, 1942). Of the possible causes of the trouble, that of latent virus infection appears to be the only one meriting further investigation. Strong evidence in favour of the infectious nature of the disease is afforded by its spread from country to country and province to province.

In an explanatory note on pp. 360–361 on Webber's attribution of the root rot to a virus occurring in a masked form in the bitter orange stock and producing symptoms only on the sweet scion, A. A. Bitancourt points out that this theory was first advanced by himself, H. S. Fawcett, and H. A. Speroni, following a tour of the affected regions in 1937.

SILBERSCHMIDT (K.). **Sôbre a provável causa da 'tristeza' das Laranjeiras.** [On the probable cause of 'root rot' of Oranges.]—*Biológico*, ix, 11, pp. 371–378, 1943.

The writer does not find Webber's virus theory of the origin of sweet orange root rot on bitter orange stocks [see preceding abstract] altogether convincing, weighty objections to its acceptance including the absence of authenticated reports of an insect vector; the nature of the symptoms, which are more suggestive of

chronic decline than acute infection; and the restoration to health both of stock and scion by separation of the two components. In any case, the evidence in support of virus agency is not sufficiently strong to justify the abandonment of other avenues of exploration.

Singh (L.) & Hamid (A.). **The cold storage of fruits in the Punjab. I. Citrus fruits: Malta (Citrus sinensis) and Sangtra (C. nobilis).**—*Indian J. agric. Sci.*, xii, 5, pp. 757–778, 1 pl., 1 diag., 3 graphs, 1942.

In connexion with studies on the cold storage of oranges at Lyallpur, Punjab, in 1938–9, chill spotting and deterioration in flavour were the principal defects at the low temperature of 29° to 32° F., whereas at the higher ranges (36° to 39° and 40° to 43°) fungal infection was the chief source of wastage, mostly associated with *Penicillium digitatum* and *P. italicum*. A species of *Alternaria* was isolated from the internal segments of the pulp near the stem end of a few fruits, while in 1939 *Colletotrichum gloeosporioides* was also implicated in the causation of stem-end rot.

Sokoloff (V. P.), Klotz (L. J.), & Turrell (F. M.). **Physiological disturbance in leaf causes mesophyll collapse.**—*Citrus Leaves*, xxiii, 3, pp. 8–10, 1943. [Abs. in *Chem. Abstr.*, xxxvii, 19, pp. 5760–5761, 1943.]

Chemical analyses of the collapsed mesophyll frequently observed in the foliage of citrus trees in the coastal regions of various localities [of southern California: *R.A.M.*, xxii, p. 14] revealed a lack of balance in the distribution of calcium, magnesium, potassium, and sodium ions between the aqueous and solid phases of the leaf tissue. Such conditions may arise from the replacement of calcium in calcium pectate by sodium or potassium, resulting in the formation in the tissue framework of a compound devoid of the requisite water-regulating properties. The abnormal condition was experimentally induced by waterlogging three-year-old orange seedlings in the presence of magnesium sulphate.

Pine (L.). **A hitherto unreported disease of the Washington Palm.**—*Phytopathology*, xxxiii, 12, pp. 1201–1204, 1 fig., 1943.

Phytomonas washingtoniae, the agent of a water-soaked leaf-spotting of the leaf blades and petioles of *Washingtonia filifera*, first observed at Tucson, Arizona, in the late autumn of 1942, is a non-spore-forming, Gram-negative, motile rod, the poles furnished with one to three flagella, 1·6 to 0·7 μ, occurring singly or in chains of three to four, and producing on crystal violet agar smooth, convex, glistening white to cream-coloured, butyrous, circular colonies, with entire margins, reaching $1\frac{1}{2}$ to 2 mm. in diameter after ten days at 20° C. The thermal death point of the organism is 47° to 48° (ten minutes in bouillon). Gelatine is liquefied and milk peptonized, but starch is not hydrolysed, neither is indol produced, nitrate reduced, nor milk coagulated. Glucose, fructose, and 1-arabinose are utilized and acidified in 24 hours, galactose and xylose in 48.

The lesions, 10 to 15 mm. in length, penetrate the entire thickness of the leaves, but in the fleshy petiole they are limited to the parenchyma tissue. Entry into the host is effected by way of the stomata. The disease flourishes under the humid, cool conditions of late autumn and winter. Since the foliage is merely blemished and not destroyed, the disease is economically important only in so far as it lowers the ornamental value of the palm.

Dunlap (A. A.). **Inhibition of Phymatotrichum sclerotia formation by sulphur autoclaved with soil.**—*Phytopathology*, xxxiii, 12, pp. 1205–1208, 1 fig., 1943.

When thoroughly mixed with the soil and autoclaved, 325-mesh dusting sulphur, at the rate of one part per 1,000 of air-dry black Houston clay soil, totally inhibited

the formation of sclerotia by the agent of cotton root rot, *Phymatotrichum omnivorum*, with no apparent effect on mycelial growth. At 1 : 2,000 the same mixture permitted only a trace of sclerotial growth, which proceeded unchecked, however, in the presence of a 1: 8,000 concentration. The repressive action of the sulphur-soil mixture is possibly due to the formation of a toxic compound on autoclaving.

YOUNG (P. A.). **Cottons resistant to wilt and root knot and the effect of potash fertilizer in East Texas.**—*Bull. Tex. agric. Exp. Sta.* 627, 26 pp., 6 figs., 1943.

In the sandy-loam fields of East Texas cotton yields are often seriously decreased by wilt (*Fusarium vasinfectum*), nematode root knot (*Heterodera marioni*), and potash hunger [*R.A.M.*, xxi, pp. 74, 450]. Two or more of these troubles may be associated in the same field, and these factors in combination present some exceptionally difficult problems.

In variety-fertilizer tests from 1937 to 1939, using fertilizer at 400 lb. per acre in 1937 and 600 lb. subsequently, adequate wilt resistance with large yields of good-staple cotton was shown by the following varieties: Clevewilt, Cook 144–68, Dixie Triumph 25–12, Dixie 14–5 str. 2, Dixie Triumph 55–85, Miller 610, Rowden 2088, Coker 4-in-1, and Deltapine 12. The rows without potash fertilizer (6-8-0) usually showed marked potash deficiency, which was absent from those with 6-8-8 fertilizer, and mild and uncommon in those with 6-8-4. In nine main varieties the use of fertilizers containing 4 per cent. potash gave increases of 18 to 53 (average 28·5) per cent. in average yield, as compared with 6-8-0 fertilizer. Increasing the potash to 8 per cent. gave additional increases of 3 to 24 (average 10·5) per cent. in the three-year-average yields. The average yield of all nine varieties for three years was 677 lb. seed cotton per acre with 6-8-0 fertilizer, 870 lb. with 6-8-4, and 948 lb. with 6-8-8. It was further calculated that 45·7 per cent. of the wilt present was associated with 6-8-0 fertilizer, 33·3 per cent. with 6-8-4, and 21·3 per cent. with 6-8-8. The 4 per cent. potash in the fertilizer decreased wilt by 12·7 per cent., and the 8 per cent. potash by a further 11·7 per cent. The potash fertilizer decreased the percentage of wilted plants in 24 of 27 tests and in eight of nine varieties. Clevewilt showed the strongest wilt resistance, and was the only variety that did not respond to potash.

In 1941 Coker 100 W.R. str. 39·5, Coker 4-in-1, Miller 610, and Tifton Dixie Triumph all showed strong wilt resistance and gave large yields of good-staple cotton, the 6-8-8 fertilizer (500 lb. per acre) apparently minimizing wilt as compared with previous seasons.

Taking the six years' results as a whole, the author found that the following varieties (arranged in decreasing order of likely value) were highly wilt-resistant: Coker 4-in-1, Coker 100 Wilt Resistant str. 39-5, Delta Dixie W.R. str. 2, Tifton Dixie Triumph, Dixie Triumph 25-12, Dixie 14-5 str. 2, Delfos 425, Miller 610, Delta-pine 12, and Stonewilt. In addition, Coker 4-in-1, Coker 100 W.R. str. 39-5, and three strains of Dixie varieties were resistant to wilt and root knot together. Miller 610 lost much of its wilt resistance in the presence of root knot.

It is concluded that farmers can prevent wilt and root knot from becoming limiting factors in cotton production by growing only those varieties that are resistant to both, using high-potash balanced fertilizers, and rotating cotton with *Crotalaria spectabilis* and sorghum.

DASTUR (R. H.) & SINGH (M.). **Studies in the periodic partial failures of the Punjab-American Cottons in the Punjab, VII. Amelioration of tirak on soils with saline subsoils (sandy loams).**—*Indian J. agric. Sci.*, xii, 5, pp. 679–695, 2 pl., 1942.

Deferred (June) sowings and additional applications of water from the flowering stage onwards improved the condition of Punjab-American cotton plants suffering

from 'tirak' (bad opening of the bolls) on sandy loam soils in experiments carried out at the Lyallpur Agricultural Farm in 1938–9, 1939–40, and 1940–1 [*R.A.M.*, xxii, p. 204].

Varada Rajan (B. S.). **A mildew on Jute.**—*Sci. & Cult.*, ix, 8, pp. 351–352, 1 fig., 1944.

In November, 1942, jute specially grown for crossing experiments at the Jute Agricultural Research Laboratories, Tejgaon, Dacca, India, was attacked by a mildew (*Oidium* sp.), which persisted up to the end of February, the coalescent lesions covering the entire upper lamina and in severe cases also involving the lower leaf blades. The petioles, stipules, axillary leaves, the entire stem, flower-bearing branches, and capsules ultimately contracted the disease, which was more prominent on *Corchorus capsularis* than on *C. olitorius*. In the following August the mildew was observed on the main crop raised during the monsoon, but in this case the symptoms were inconspicuous, consisting merely of a few greyish or whitish patches on the stem and very sparse foliar infections.

The hyaline, septate hyphae of the fungus range from 2·9 to 7·8 μ in diameter, the erect, stout or slender conidiophores from 70 to 140 μ in length (average 94·5 μ), and the hyaline, elliptical, smooth, unicellular conidia, from 21·5 to 54·2 by 13 to 23·3 (33 by 17·4) μ, often in chains of two or more.

This is apparently the first record of a mildew on jute.

Vanterpool (T. C.). **Studies on Crown and Royal Flax in Flax-sick soil. I. The determination of Crown and Royal seed samples by growth in Flax-sick soil. —II. Comparative mortality response of Crown and Royal Flax in two different Flax-sick soils.**—*Sci. Agric.*, xxiv, 6, pp. 259–267, 3 figs.; pp. 268–270, 1 fig., 1944.

As it has been generally recommended that the cultivation of the Crown variety of flax should be discontinued in Saskatchewan because of its susceptibility to *Fusarium lini*, and that the moderately resistant Royal should be grown instead, experiments were carried out to devise a quick and reliable means of ascertaining the identity of undetermined seed stocks of these varieties, which cannot be separated visually.

A comparison was made of the percentages of wilt (total plant mortality) in 96 such samples grown in soil in the greenhouse, and 68 samples in both the greenhouse and the field, the University strains of the two varieties serving as controls. With few exceptions the incidence of wilt in each variety was about 13 per cent. higher in the field than that in the greenhouse, but in every instance the varietal determinations in the greenhouse and in the field were in agreement. It is concluded that for the time being the greenhouse method can be used without field test.

There was evidence that five of the 96 samples tested were mixtures of Crown and Royal; that mixing can occur is shown by admixtures of Bison and Redwing seeds in samples of Crown and Royal, and great care should be taken by producers to prevent Royal stocks being contaminated with Crown.

In the second paper the author states that rather higher percentages of wilt (*F. lini*) have been reported on Royal flax grown in wilt nurseries in eastern Canada and the northern areas of the United States than have been recorded in the wilt nursery at Saskatoon, Saskatchewan, and points out that under certain conditions other fungi, such as *Rhizoctonia* [*Corticium*] *solani*, *Pythium debaryanum* [*R.A.M.*, xv, p. 440], and *F.* spp. also contribute to plant mortality in such soils. He describes an experiment in which the highly wilt-susceptible Crown variety and the moderately resistant Royal were grown under greenhouse conditions in wilt-infested soil from Ottawa and from two nurseries at Saskatoon. Royal flax

showed only moderate survival, with 36 per cent. wilt (as expressed in post-emergence mortality) in the Ottawa soil, and high survival, with only 10 to 12 per cent. wilt, in the Saskatoon soils. Crown flax showed fair survival, with 66 per cent. wilt, in the Ottawa soil, and poor survival, with 97 to 99 per cent. wilt, in the Saskatoon soils.

This result indicates that the strains or species of pathogenic fungi in the Ottawa soil are more virulent on Royal flax and less virulent on Crown than are the strains or species of fungi in the Saskatoon soils. In all the flax-sick soils Crown flax showed a definite progressive plant mortality up to the final survival count; Royal showed a moderate progressive mortality in the Ottawa soil, but only a slight increase in mortality after the first count in the Saskatoon soils. This may indicate that the killing of Royal in the early seedling stage in the Saskatoon soils is chiefly of the damping-off type (*P.* spp. and *C. solani*), whereas in the Ottawa soils some other fungus is responsible for the later killing of Royal.

MILLIKAN (C. R.). **'Withertop' (calcium deficiency) disease in Flax.**—*J. Dep. Agric. Vict.*, xlii, 2, pp. 79–91, 8 figs., 2 graphs, 1 map, 1944.

Flax in Victoria is affected by a condition referred to as 'withertop', which, since it was first observed in 1939, has caused severe losses. The damage sustained has varied from a trace to 100 per cent., over an area of up to 100 acres at a time. In the Colac district in 1941, 10 per cent. of the area under flax was not harvested because of the disease. The general loss in Victoria probably amounts to about 1 per cent.

The disease appears at any time from mid-September onwards. The crops do not become affected until they are 12 to 15 in. high and are making rapid growth. As a rule, very little withertop develops after about the middle of October. In one instance a very early crop of Liral Crown showed the condition towards the end of August. Prevalence is usually greater in early- than in late-sown crops.

Symptoms develop in a few hours. A sharp bend occurs 2 to 4 in. below the tip of the plant. At the point of the bend the stem soon loses rigidity, and the top of the plant hangs down vertically. When bending first occurs, there is no sign of browning at the bend or above it. Necrosis, however, sets in at the point of the bend, and spreads rapidly until the whole of the bent-over portion is dead. Affected patches in a crop appear brown when seen from a distance. The stem below the bend remains apparently normal. The diseased plants may occur in well-defined patches where the ground is waterlogged, or a whole crop may be affected. A few days after the browning at the top of the stem has started, the plant usually sends out secondary shoots from the axils of the leaves immediately below the affected top. When drier weather sets in, these shoots develop normally, but where the soil again becomes waterlogged, this second growth may also develop the condition. If withertop occurs some time after bud formation, only the individual flower stalks may collapse. A very mild form of the disease, involving only a necrosis of the flower sepals from the tips downwards, has also been observed. Severely affected plants produce short fibre of low value. Where second growth has occurred, the fibre is generally broken during the scutching process at the point where it joins the main stem, two fibres of much less than standard length being produced.

Mineral deficiency tests with sand and water cultures showed that whereas mild calcium deficiency symptoms were identical with those of withertop in the field, the symptoms of phosphorus, nitrogen, magnesium, potassium, zinc, and copper were quite different. Typical withertop developed in flax plants grown in a complete nutrient solution until they had reached a height of 15 in. and then removed to a calcium-deficient solution. Chemical analyses showed that withertop plants had a much lower calcium concentration than healthy plants from the same crop.

In pot tests incidence was increased by waterlogging. The effect appears to be greatest when the waterlogging occurs about the time the plant is 12 to 15 in. high and rapidly lengthening. Before this stage was reached flax plants tolerated long periods of waterlogging. In such cases growth was retarded. After ten weeks' waterlogging some plants developed a 'tip necrosis' apparently identical with symptoms of severe calcium deficiency.

Pot experiments demonstrated that the disease was controlled by an application of lime or gypsum at rates varying from 1 to 4 tons per acre. In a field test as little as 3 cwt. slaked lime per acre gave appreciable reduction in withertop, while with 4 tons limestone per acre the disease was completely absent. All the straw from the unlimed areas was worthless for fibre, while the limed plants produced a heavy yield of high-quality straw.

TOBLER (F.). **Flachsrost und Bastfaser.** [Flax rust and harl fibre.]—*Faserforsch.*, xv, pp. 132–135, 1941. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 1–4, p. 74, 1943.]

The anatomical study of harl fibres derived from flax infected by rust [*Melampsora lini*] revealed varietal differences in the nature of the attack and its effect on the firmness of the material and its suitability for retting. Thus, the primary tissues of the Karnobat variety, designated by Straib as 'virtually free from infection' [*R.A.M.*, xxi, p. 490], contained an abundance of brown mycelium, which was absent from the fibres. The latter, on the other hand, sustained heavy damage in the least resistant variety, Svalöf Hercules. It is evident, therefore, that the action of the rust on the fibres, as well as the external symptoms of the disease, must be taken into account in assessing the extent of the injury from this source.

GARBER (K.). **Hagel- und Pilzschäden an Fasernesselstengeln.** [Hail and fungal injuries on Fibre Nettle stalks.]—*Faserforsch.*, xv, pp. 38–40, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 1–4, pp. 73–74, 1943.]

Whereas hail injuries do not impair the utility of nettle stalks for fibre production, the portions invaded in a secondary capacity by *Cladosporium elegans* cannot be detached, since the mycelium penetrates the cortex and envelops the fibres, which in this way become bound to the cambium. The development of the pathogen is favoured by liberal nitrogenous manuring and heavy precipitation.

CALVERT (E. L.) & MUSKETT (A. E.). **Blind seed disease of Rye-Grass.**—*Nature, Lond.*, cliii, 3879, pp. 287–288, 1944.

In further investigations carried out in Northern Ireland on the infection of rye grass [*Lolium perenne* and *L. multiflorum*] by blind-seed disease (*Phialea temulenta*) [*R.A.M.*, xxi, p. 455, and cf. next abstract], the authors observed sporodochia producing endogenous microspores on affected seeds and in culture. In inoculation tests *Pullularia pullulans* was found to be non-parasitic [cf. ibid., xix, p. 709]. When the blind-seed fungus was used in suspensions of ascospores and macrospores, heavy infection resulted at flowering time on one commercial type and two indigenous strains of perennial and one commercial type of Italian rye grass. When inoculations were made after fertilization, the amount of infection rapidly declined. When the seed produced was tested, highly significant negative correlations were obt ainedbetween percentage infection and percentage germination for each variety.

The blind-seed fungus was isolated from *Festuca ovina*, *Agrostis canina*, *A. palustris*, *Poa pratensis*, *Holcus lanatus*, and *Cynosurus cristatus*. Cultures from the first three hosts and one from rye grass gave successful infection on *F. elatior*, *P. trivialis*, and rye grass.

In laboratory, pot, and field tests, full control followed hot-water seed treatment (15 minutes at 50° C.) preceded by four hours' immersion in tepid water, or 30

minutes at 50° without pre-immersion. When the seed was dried immediately after treatment, little, if any, reduction in germination resulted.

In a field test in which the plots were separated by paths 2 yds. wide, no treatment reduced infection in the seed produced, ascospores being carried from plot to plot and setting up primary infection. Small plots remote from rye grass crops were then sown with infected, treated seed, and similar plots in other areas with untreated seed. Examination of the seed produced showed that the percentage infection in 10 of the plots sown with untreated seed ranged from 0 to 38 per cent. (mean 8), while in 15 plots sown with treated seed the figures were 0 to 55 (mean 11) per cent. These results indicate that infection had occurred from some source other than the seed.

Examination of numerous seed samples since 1939 clearly showed that strains of indigenous perennial rye grass are more susceptible to the disease than commercial types. The amount of infection present in a crop was found to be influenced by the previous cropping, and it was also ascertained that seed samples from fields sown with heavily infected seed did not, on the average, show higher infection than those from fields sown with seed almost free from the disease.

As rye grass is mainly used as a forage crop and the seed is used chiefly for propagation, too much importance can be placed on reduced germination. Until evidence is forthcoming that the disease reduces the value of the crop, it must be assumed that the damage is restricted to an attack on the seed. The seed from indigenous strains is more liable to heavy infection than seed from commercial types, but if the indigenous crops are of much greater feeding value, then reduction in germination is of secondary importance. In Northern Ireland there would be few seasons when, by proper blending, the seed could not be brought up to a standard of germination suitable for incorporation in mixtures intended for pasture establishment in areas not producing seed. The best seed should be kept for distribution in seed-producing areas. In this way a supply of seed of the valuable indigenous strains would be made available until leafy, resistant strains can be introduced.

The occurrence of seasons when the germination of rye grass seed is low is attributed to the incidence of the blind-seed disease, which must therefore be regarded as of long standing.

Neill (J. C.) & Hyde (E. O. C.). **Blind-seed disease of Rye grass, II.**—*N.Z.J. Sci. Tech.*, xxiv, A, 2, pp. 65–71, 3 figs., 1942. [Received March, 1944.]

Further investigations into blind seed disease of rye grass [*Lolium perenne*] in New Zealand [*R.A.M.*, xviii, p. 601, and cf. preceding abstract] gave the following additional hosts: *Festuca arundinacea*, *F. elatior*, and *F. rubra* var. *fallax*. In four of five samples of infected rye grass seed oven-drying prevented the growth of the fungus without reducing seed germination. A general inverse correlation was established between the amount of pre-harvest infection and the germination of the crop. Air-dried macroconidia retained their vitality for 12 days at laboratory temperatures, but germination subsequently declined both in numbers and in rate until the 26th day, after which no further germination was noted. One small experiment indicated that systemic infection does not occur.

Apothecia were readily produced from infected seed of the current year's harvest by scattering seeds on or just under the surface of moist sand in Petri dishes, keeping them at 3° to 4° C. for one to four months, and then exposing them to the light at laboratory temperatures. The sound seeds germinated, but the seedlings soon died, and did not interfere with the apothecia that developed from the blind seeds. Microconidial sporodochia usually appeared on the infected seeds before removal from the refrigerator, and apothecia in six weeks to three months after. Apothecia were not produced in culture. It was found that the microconidia

were liberated in succession from within the tubular apex of the sterigmata in the manner characteristic of *Endoconidium temulentum* as described by Prillieux and Delacroix. In a feeding trial infected seed showed no toxic effect on sheep.

In an addendum the authors state that they obtained rye seeds from the original collection (Dordogne, 1891) on which Prillieux and Delacroix erected the genus and species *E. temulentum* and the apothecial form *Phialea temulenta*. Most of the seeds were coated with dry conidia indistinguishable from macroconidia of the blind-seed fungus. Sections showed the ramification of hyphae within the endosperm, as described by Prillieux and Delacroix, and the epidermal development of macroconidia, typical of blind seeds of rye grass, tall fescue (*F. arundinacea*), and darnel (*L. temulentum*). Apothecia of the blind-seed fungus and those described for *P. temulenta* were alike except for measurements of asci and ascospores, so that blind-seed disease and 'seigle enivrant' appear to be due to the same fungus, *P. temulenta*. This name has been changed twice—by Prillieux (1897) to *Stromatinia temulenta* and by Saccardo (1906) to *Sclerotinia temulenta*. As *Stromatinia* is invalid and the fungus is certainly not a *Sclerotinia* it appears that the original name *P. temulenta* should stand.

In a second appendix it is stated that apothecia have now been produced in the laboratory from rye and darnel seeds taken from heads artificially inoculated with blind-seed conidia from darnel. Ascospores from these apothecia produced typical macro- and microconidia. These apothecia agree with those described in the authors' earlier paper, except that the dimensions are larger. There appears to be no justification for the name *P. mucosa* [ibid., xxi, p. 456] in respect of host, life-history, pathology, macroconidia, microconidia, apothecia, asci, or ascospores. The measurements as given by Prillieux are: asci 130 by 5, and spores 10 by 4·5 μ, while those given by Miss Gray for *P. mucosa* are 66 to 116 by 3·3 to 7 and 7·6 to 12 by 3·6 μ, respectively, the authors' measurements being, on *L. perenne*, 70 to 80 by 4·5 to 5 and 7 to 8 by 3 to 4 μ, and on rye 76 to 121 by 4·8 to 6·4 and 5·5 to 9·5 by 3·5 to 4·8 μ. These differences scarcely have taxonomic value.

Musser (H. B.) & Thornton (J. K.). **Local, domestic and foreign Red Clover seed.**—*Bull. Pa agric. Exp. Sta.* 458, 17 pp., 1 fig., 1943.

The following points of phytopathological interest emerge from a survey of the tests of red clover strains of diverse origins which have been carried on intermittently since their inception in 1921. Seed from Virginia, Kentucky, and Tennessee, generally considered to be resistant to southern anthracnose (*Colletotrichum trifolii*), produced satisfactory yields over a protracted period, and a blend of the best strains of this material is being increased, in co-operation with the United States Department of Agriculture, under the name of Cumberland [*R.A.M.*, xxiii, p. 22]. Similar arrangements have been made in connexion with Midland [loc. cit.], another satisfactory combination of two identified strains from Ohio and one from Illinois. In general, the disease problem is not acute in the northern clover-growing region, but northern anthracnose (*Kabatiella caulivora*) contributes to yield reductions in the central districts, comprising Ohio, Iowa, Indiana, Illinois, West Virginia, part of Maryland, and central and western Pennsylvania.

Carrera (C. J. M.) & Noll (W.). **La importancia de algunas species de 'Fusarium' en el pietín y marchitamiento de 'Lupinus albus', 'Lup. angustifolius' y 'Lens esculenta' en el Uruguay.** [The importance of some species of *Fusarium* in the foot rot and wilt of *Lupinus albus*, *Lup. angustifolius*, and *Lens esculenta* in Uruguay.]—*An. Soc. cient. argent.*, cxxxi, 4, pp. 152–184; 5, pp. 185–211, 15 figs., 1941. [German and Italian summaries. Received December, 1943.]

This is an exhaustive study of a foot rot and wilt of white and blue lupins (*Lupinus albus* and *L. angustifolius*) and lentils observed, for the first time in

Uruguay, in 1938–9, on the experimental plots of the 'La Estanzuela' Phytotechnical Institute, where it caused substantial damage. Previous contributions to the knowledge of lupin fusarioses are summarized and discussed, but no record of the lentil being affected has been found. Distinctive features of the disease include the destruction of the root tissues, infection proceeding from the exterior to the interior; penetration of the hyphae into the vascular system of the roots and stem bases; a reddish-brown discoloration of the vessels up to a few centimetres above the externally recognizable zone of invasion; and the more or less sudden onset of wilting, accompanied by the premature death of the plants.

The diseased material yielded the following species: *Fusarium avenaceum* (seven isolates from eight white, seven from eight blue lupins [*R.A.M.*, xviii, p. 832], and four from six lentils), *F. scirpi* var. *acuminatum* (one from white, five from blue lupins, and four from lentils), *F. oxysporum* var. *aurantiacum* (five from white and one from blue lupins), *F. solani* (one each from white and blue lupins), *F. orthoceras* (one from blue lupins), and *F. culmorum* (two from lentils). All these species are new records for eastern Uruguay.

All the organisms were pathogenic in varying degrees to their own hosts in inoculation experiments, the most virulent symptoms being induced by *F. avenaceum* on both lupins and lentils and by *F. scirpi* var. *acuminatum* on *L. angustifolius*. The infection caused by *F. solani* on lupins was noticeably mild, while the attacks of *F. orthoceras*, *F. oxysporum* var. *aurantiacum*, and *F. culmorum* were of intermediate severity. In cross-inoculation tests *F. avenaceum* and *F. scirpi* var. *acuminatum* from white lupins and lentils, and *F. orthoceras* from the latter, were equally pathogenic to blue lupins, showing no decided preference for their own hosts. In general, the symptoms developing on inoculated plants agreed with those observed in the field, and reisolations established the identity of the causal organisms. *F. orthoceras* and *F. solani* are stated to be the only species, among those under investigation, previously implicated in the causation of wilt and foot rot (of blue lupins). The individual species could not be differentiated on the basis of the appearance of the infected plants, which responded similarly, though in differing degrees, to all the pathogens.

Both in the open and in inoculation experiments, the damage from the fusarioses was more extensive in hot than in cool weather, but further investigations are required to base control measures on this factor.

Hardison (J. R.). **Specialization of pathogenicity in Erysiphe graminis on wild and cultivated grasses.**—*Phytopathology*, xxxiv, 1, pp. 1–20, 1944.

At the Kentucky Agricultural Experiment Station the writer studied 318 accessions of 18 species and nine varieties of 25 genera of wild and cultivated grasses, besides 15 varieties of barley, one of rye, two of summer wheat, and one of oats in respect of their reaction to eight cultures of *Erysiphe graminis*. All the cultures used in the trials infected species of two or more genera, this result disproving previous conclusions as to the restriction of pathogenicity to a single host genus.

The inoculation technique, based on the scattering or dilution method of Mains [*R.A.M.*, ix, p. 58] and Tidd [ibid., xvi, p. 376], is fully described. The five reaction types of Mains and Dietz [ibid., ix, p. 643] were employed, the experimental data being tabulated and the significant points discussed.

Culture 18 from rye at Yakima, Washington, was almost completely confined to its own host, the only other infection being a very mild one on *Agropyron spicatum*. The freedom from mildew of the other grasses tested is stated to constitute the first large-scale evidence of the non-pathogenicity to extraneous hosts of *E. graminis* from rye.

Culture 2 from summer wheat at Ann Arbor, Michigan, severely attacked

Aegilops crassa, *A. cylindrica*, *Agropyron striatum*, *Elymus condensatus*, and *E. junceus*, while *Aegilops triuncialis*, *Agropyron inerme*, *A. spicatum*, *E. canadensis*, *E. dahuricus E. triticoides*, *E. glaucus*, *E. sibiricus*, and *Sitanion hystrix* were moderately susceptible, and *S. jubatum* semi-resistant to the mildew from this source, which was hitherto recorded only on *Aegilops* outside the genus *Triticum* [ibid., xii, p. 362]. Culture 2 would appear, from a comparison of the author's results with those of Mains [loc. cit.], to be identical with the latter's physiologic race 1.

The Arlington C.I.702 and Hanna C.I.906 barley varieties were highly resistant to culture 3 from the same host (Ann Arbor), Duplex C.I.2433, Goldfoil C.I.928, Heil's Hanna C.I.682, and 244 C.I. 1021 very resistant, Black Hull-less C.I.666, Common Chile C.I.663, Lynch C.I.919, and Nepal C.I.595 moderately resistant, Coast C.I.276, Oderbrucker C.I.940, and Peruvian C.I.335 moderately susceptible, and Horsford C.1.877 and Malting C.I.1129 very susceptible. *Agropyron intermedium* and *A. trachycaulum* proved moderately susceptible to culture 3, *A. striatum* moderately resistant, and *A. spicatum* and *E. glaucus* very resistant, this being the first record of infection by barley mildew on grasses outside the genus *Hordeum*.

The Horsford C.I.147 and Malting C.I.326 barleys were very susceptible to a mixed culture from *A. repens* (Yakima). The mildew on barley was increased and designated culture 7, while the other component was numbered 6. The latter was the most aggressive of all the cultures tested, being more or less pathogenic to all *A.* spp. and also attacking *Aegilops cylindrica*, nine species or varieties of *Elymus*, *Hystrix patula*, *S. hystrix*, and *S. jubatum*. This wide infection range is in sharp contrast to the concept of narrow specialization of the *Agropyron* mildew advanced by Marchal (*C.R. Acad. Sci.*, *Paris*, cxxxvi, pp. 210–212, 1902) and heretofore accepted by later workers. To culture 7 the Arlington C.I.702, Goldfoil C.I.928, Horsford C.I.147, Malting C.I.326, and Peruvian C.I.925 barleys were very susceptible and Black Hull-less C.I.666 and Nepal C.I.595 moderately resistant. *A. repens*, its own host, was the only wild grass reacting with any appreciable degree of susceptibility to this culture, the virulence of which to Arlington C.I.702 differentiates it from all previously described races of *Erysiphe graminis hordei* in the United States.

Two isolates from a bulk culture of the mildew from *Elymus dahuricus* (Ann Arbor) were studied, viz., culture 10, originating from the inoculation of Malakoff C.I.4898 wheat by conidia of the mixed culture, and 11, isolated on *A. desertorum* similarly inoculated. Culture 10 attacked numerous species of *Aegilops*, *Agropyron*, *Elymus*, *Hystrix*, *Sitanion*, and *Triticum*; the Malakoff C.I.4898 and Axminster C.I.1839 wheats were very susceptible and moderately resistant, respectively. Culture 11, on the other hand, was capable of infecting only *A.* and *E.* spp.

Culture 13 from *E. condensatus* (Pullman, Washington) was more or less pathogenic to most of the *A.* and *E.* spp. tested and very mildly so to *S. hystrix*. It is comparable in several respects to 11, including the brownish colour of the mycelium in both, but the two collections are distinguishable on the basis of the reactions of various grass accessions.

The differences in reaction to *Erysiphe graminis* of strains within grass species are of importance in the selection of economic grasses. Several selections have shown outstanding resistance to all the cultures.

GRASBY (C. G.). **Some common pests and diseases in the Murray Irrigation Areas.**—*J. Dep. Agric. S. Aust.*, xlvii, 4, pp. 152–158, 8 figs., 1943.

A spray programme for fruit-growers in the Murray Irrigation Area, South Australia, is given, designed for the control of various insect pests and fungal diseases of stone fruits, citrus, and vines.

TAYLOR (G. G.) & BRIEN (R. M.). **Ripe-spot of Apples (Neofabraea malicorticis).**—*N.Z. J. Sci. Tech.*, A, xxv, 2, pp. 63–72, 8 figs., 1 graph, 1943.

In connexion with the increasing importance of apple ripe spot (*Neofabraea malicorticis*) in New Zealand the symptoms of the disease and the morphology of the pathogen are described, and the incidence and economic importance of the trouble and the factors affecting it discussed. The fungus has been reported from all fruit-growing districts, but most of the damage occurs on the highly susceptible Sturmer variety in the Nelson area. Factors contributing to a high percentage of infection include late picking, delay in placing the fruit in storage, and unduly high storage temperatures. The comparative features of ripe spot and similar types of infection occurring on New Zealand apples are tabulated, with additional notes for assistance in diagnosis.

KIDSON (E. B.), ASKEW (H. O.), & CHITTENDEN (E.). **The value of magnesium compounds for the control of magnesium deficiency of Apple trees.**—*N.Z. J. Sci. Tech.*, A, xxv, 1, pp. 31–42, 4 figs., 1943.

Magnesium compounds supplying approximately 500 or 1,000 gm. magnesium oxide per tree, applied in the winter of 1939 to 1940 to apple trees in two localities in the Nelson district of New Zealand, produced a gradual improvement [*R.A.M.*, xix, p. 604] during the three following seasons, notably in Sturmers, the other varieties (Delicious, Jonathan, and Cox's Orange) included in the trials reacting less satisfactorily. The element was given in the form of top dressing as sulphate, carbonate, or dolomite, of which the first two acted more rapidly, while the beneficial effects of the third became more noticeable with time. The increased magnesium contents of the leader leaves of the treated trees were mostly consistent with the degree of visible recovery. As in the previous experiments, magnesium salt injections maintained individual branches in good health on magnesium-deficient trees.

CULLINAN (F. P.) & BATJER (L. P.). **Nitrogen, phosphorus and potassium interrelationships in young Peach and Apple trees.**—*Soil Sci.*, lv, 1, pp. 49–60, 1 graph, 1943.

In the six years' experiments at the Bureau of Plant Industry, United States Department of Agriculture, the vegetative growth of Elberta peach and York apple trees was found to be markedly affected by an inadequate supply of nitrogen in the nutrient solution. Under these conditions the effects of low phosphorus or low potassium on growth are not conspicuous, but with a high nitrogen level (upwards of 60 p.p.m.), deficiency symptoms develop when either phosphorus or potassium is present in low concentration, peaches suffering much more severely than apples. Full details of the results are given.

WILLISON (R. S.). **Brown rot and other fungal wastage in harvested Peaches.**—*Sci. Agric.*, xxiv, 5, pp. 221–233, 6 graphs, 1944.

In spraying tests carried out in Ontario from 1938 to 1942, inclusive, for the control of peach brown rot [*Sclerotinia fructicola*: *R.A.M.*, xviii, p. 535], incidence during the first week after harvest was reduced by 40 to 65 per cent. in the worst years and by 65 to 100 per cent. in the other years by a four-spray schedule consisting of (pre-blossom 'shucks') koloform, kolofog, Bartlett's standard wettable sulphur, lime-sulphur (1–50) or C.O.C.S., ('shucks') koloform, kolofog, Bartlett's standard wettable sulphur (all three with lead arsenate, zinc sulphate, and lime), or aero-sulphur; (three weeks before harvest) koloform, kolofog, standard wettable, and aero; and (pre-pick) kolopick or dust, kolopick or kolopre-pick, Bartlett's pre-pick or dust, ferrox flotation sulphur, or aero sulphur.

The weather experienced in the early part of the season may exercise a marked effect on control, through its influence on spore load and, perhaps, on the inherent susceptibility of the fruit, giving rise to what is termed the basic incidence of infection for the season. In view of the unpredictability of local weather, all four sprays should be applied, the third at not more than three weeks, and the last a day or two, before harvest is expected. As the sprays are more fungistatic than fungicidal, spraying should not be regarded as a substitute for other precautions. For instance, peaches should not be handled when wet or allowed to become damp after picking. Wrapping the fruits in tissue reduced the likelihood of contamination in the pack.

The evidence showed that brown rot infection can occur at 33° F. At this temperature, however, incubation is prolonged, so that, for practical purposes, prompt refrigeration at or below 45° is satisfactory. When the transportation period is over one week, storage at 33° is recommended; for shorter periods, 45° is satisfactory. During the first few days after the removal of peaches to room temperature, the rate of incidence of brown rot declines as the storage temperature is gradually brought down to 32°, but it rises again as the period in cold storage is increased.

Rot due to *Rhizopus nigricans* [*R. stolonifer*] was not found on peaches during refrigeration, but was sometimes serious after storage. It rarely appeared at room temperature until the second week after picking, except when the pack was damp. It tended to spread from fruit to fruit forming nests of rot, and did not appear to respond to spraying.

KEITT (G. W.), MOORE (J. D.), CALAVAN (E. C.), & SHAY (J. R.). **Occurrence of the imperfect stage of Sclerotinia laxa on Prunus cerasus in Wisconsin.**—*Phytopathology*, xxxiii, 12, pp. 1212–1213, 1 fig., 1943.

In June, 1941, *Sclerotinia laxa* was isolated on potato dextrose agar from the internal tissues of severely blighted Montmorency and Early Richmond cherry varieties in Door County, Wisconsin. In the spring of 1942 the sporodochia of the fungus were observed in profusion on the blighted fruit spurs of the preceding year, as well as on the remnants of the petioles and midribs of the leaves and persistent parts of the overwintered diseased blossoms. Although a severe local outbreak of the blight occurred at this time, no sporodochia could be found on the current season's lesions, but in the spring of 1943 a few of these organs did develop on recently produced infections. Inoculation experiments with pure cultures of *S. laxa* on Montmorency blossoms and twigs gave positive results, the pathogen being reisolated from the diseased tissues and successfully used in re-inoculation tests. This is believed to be the first record of *S. laxa*, the common agent of brown rot in Europe, Manchukuo, and Japan, for central or eastern North America.

KEITT (G. W.) & MOORE (J. D.). **Masking of leaf symptoms of Sour-Cherry yellows by temperature effects.**—*Phytopathology*, xxxiii, 12, pp. 1213–1215, 1943.

Particulars are given of bud-grafting experiments at Madison, Wisconsin, in 1942–3 with the cherry yellows virus [*R.A.M.*, xxii, p. 440], the results of which demonstrated the masking effect on the foliar symptoms on the Montmorency variety of constant temperatures of or exceeding 20° C. At 16°, on the other hand, the typical features of the virus are clearly expressed.

FOX WILSON (G.) & GREEN (D. E.). **Observations on two Raspberry troubles.**—*J. R. hort. Soc.*, lxix, 3, pp. 79–86, 1 fig. (facing p. 71), 1944.

The examination of raspberry canes suffering from progressive deterioration at the Royal Horticultural Society's Gardens, Wisley, Surrey, disclosed the

presence of two organisms, viz., the cane midge, *Thomasiniana theobaldi*, and the cane blight fungus, *Leptosphaeria coniothyrium*. The question as to the relative severity of the two pathogens and their possible etiological connexions is left open pending further studies.

The stocks most heavily damaged by *L. coniothyrium* in 1941 were some East Malling seedlings and the Newburgh variety. In the following year the trouble was equally acute, and was observed to be spreading to other varieties. Excision of the diseased material, combined with the application of Bordeaux mixture, failed to control the blight in 1942–3: the results of subsequent tests in the latter year, in which all the old canes, both healthy and infected, were eliminated, will not be apparent until the 1944 season. It seems evident that the critical period for the invasion of the canes by *L. coniothyrium* is at a very early stage of growth, possibly on their first emergence from the soil, so that timely spraying is essential, but much more information is required concerning the life-histories both of the cane midge and the blight fungus before rational control measures can be instituted.

Wallace (G. B.). **Diseases of Papaws.**—*E. Afr. agric. J.*, ix, 3, pp. 175–176, 1944.

A preliminary account is given of a disease of papaw found recently on a few estates in Northern Province, Tanganyika Territory. The condition, which appears to be due to a species of *Pythium* or *Phytophthora*, or, more probably, to more than one species, causes a certain amount of damage to individual fruits, and is capable of killing seedlings and mature trees. In general, only a few succumb, and the cumulative amount of loss may not at first be appreciated.

The disease attacked 20 per cent. of the seedlings in a large field on Kilimanjaro in June and July, 1943. The effect was a damping-off or foot rot. The roots seemed healthy, but dark, water-soaked lines ran up the stems. Older seedlings were shrunken, dried, and flattened.

In older trees the fungus can attack the roots and collar, but most infections occur in the upper parts. The fungus generally effects its entry at the scars left by fallen leaves, flowers, or fruits. When it penetrates an old leaf scar below the existing foliage, it causes a rotting of the stem; the part above falls over, leaving only the bare stem standing. This may send out new shoots from below. When the fungus enters a scar among the leaves and fruits, it spreads to the leaf-stalks or fruits, causing them to fall off. Many fallen fruits show the rot, but most infections of fallen fruits appear to arise after they have dropped.

In some trees the collar and upper roots are soft and rotten. This usually marks the disease as it occurs in South Africa, where it is known as 'foot rot' [*R.A.M.*, xi, p. 330; cf. xxi, p. 150]. Trees so affected show wilting and yellowing of the foliage, followed by leaf fall, and are easily blown or pushed over. Preventive measures based on South African experience consist in providing good growing conditions and in avoiding injury to the plants; in affected seed-beds the soil should be treated with Cheshunt compound and the sowings made thinly. The same compound should be used for watering the soil after removal of affected plants from the field. If the upper parts of the trees are affected, control depends on field sanitation. All affected material should be destroyed and replanting should not take place until a suitable period has elapsed. Where a papaw field adjoins the overgrown banks of a river, a clear, uncultivated area should be made.

Other papaw diseases found locally are mildew (*Ovulariopsis papayae*) [ibid., xii, p. 680], for the control of which sulphur dusting is suggested, and anthracnose (*Colletotrichum gloeosporioides*) [ibid., xxi, p. 149].

Loustalot (A. J.). **Apparent photosynthesis and transpiration of Pecan leaves treated with Bordeaux mixture and lead arsenate.**—*J. agric. Res.*, lxviii, 1, pp. 11–19, 5 graphs, 1944.

In an investigation carried out in Texas in 1941 mature leaves of a 10-year old

pecan tree carrying a full crop of nuts were treated on three occasions in June and July with 6-2-100 and 8-8-100 Bordeaux mixture and in two experiments in September and October with 6-100 lead arsenate. In every case the material was applied to both surfaces by dipping the leaves twice into an agitated, freshly prepared mixture and allowing the material to dry between the immersions. The spray material had thoroughly dried when the determinations of apparent photosynthesis or transpiration were made. In no instance did either treatment have any appreciable effect on these processes.

STODDARD (E. M.) & HEUBERGER (J. W.). **Eradicant action of fungicides on spores on living plants.**—*Phytopathology*, xxxiii, 12, pp. 1190–1195, 1943.

The writers' studies at the Connecticut Agricultural Experiment Station were concerned solely with the eradicant action of fungicides on the spores present on living plants, and the measurement of this effect in terms of spore mortality and its relation to subsequent control of the fungus. This aspect of combating plant diseases has hitherto received little attention, interest having been much more widely focussed on the protective action of fungicides on the host, manifested in the prevention of spore development. The pathogens used in the tests were carnation rust (*Uromyces caryophyllinus*) and apple scab (*Venturia inaequalis*), and the fungicides were tetrachloro-para-benzoquinone (spergon), tetramethylthiuram disulphide (Japanese beetle spray), ferric dimethyl dithiocarbamate (fermate), mercaptobenzothiazole (captax), dinitro-ortho-cresol dye (elgetol), liquid lime-sulphur, wettable sulphur (mike), copper oxychloride (compound A), yellow cuprous oxide (yellow cuprocide), and Bordeaux mixture.

The carnation rust experiments were conducted in the greenhouse, a total of four treatments being given on 29th January, 6th and 20th February, and 13th March. Thirty-five days after the last application the percentage of spore germination (based on 600 spores from 30 leaves per treatment) in aqueous suspensions (5,000 to 1 c.c.) incubated overnight at 20° C. for the controls, tetramethylthiuram disulphide, tetrachloro-para-benzoquinone, ferric dimethyl dithiocarbamate, mercaptobenzothiazole (all at 0·25 per cent.), and mike wettable sulphur (0·75) were 63, 6, 8, 22, 62, and 61, respectively, the corresponding figure for yellow cuprous oxide (0·25) after 17 days being 43, and the number of new infections per 1,000 leaves (above the level obtaining at the commencement of the programme) 20·6, 0·9, 1·7, 1·8, 6·4, 6·1, and 7·8, respectively. It is apparent from these data that a correlation exists between spore mortality and the incidence of fresh infections.

For the apple scab tests overwintered leaves were placed under two-year-old McIntosh trees in the field early in April. Ascospores were discharged on 15th and 16th May, and lesions appeared on the foliage on the 27th. On 5th June five trees in each of four replicated blocks were sprayed with two dosages of the various fungicides (0·25 and 0·0625 per cent.), and on 16th June their effects on conidial mortality were determined by 48 hours' incubation of suspensions from scab lesions on 40 leaves, chosen at random from the 80 collected for each dosage. On 21st July the new leaves produced after the completion of spraying were divided into two groups, representing the side and top branches, to ascertain the possible influence on scab incidence of the washing by rain of the eradicants from the sprayed to the untreated foliage, and counts made of the fresh infections occurring after the termination of spraying. The percentage of conidial germination ranged from nil for fermate and yellow cuprocide (both concentrations) to 74 per cent. for elgetol (0·0625 per cent.), the figure for the control being 64 per cent.; substantial reductions were also effected by Japanese beetle spray (1·5 and 2 per cent. for the two concentrations) and mike sulphur (2·5) at the higher strength. The percentages of diseased leaves on the treated side branches ranged from 16

(yellow cuprocide, 0·25 per cent.) to 77 (lime-sulphur, 0·0625), and on the top ones from 7·5 (yellow cuprocide, 0·25 per cent.) to 36·5 (mike sulphur, 0·0625), the corresponding figures for the controls being 74·8 and 30·2 per cent., respectively. As in the case of carnation rust, there was a general agreement between high spore mortality and a low incidence of reinfection. The new leaves on the side branches were uniformly more severely damaged than those on the top ones, indicating that the washing of fungicides from the sprayed to the untreated foliage had little or no bearing on control; the amount of scab on the unsprayed foliage, therefore, is directly related to the eradicant value of the materials. The most powerful eradicant, yellow cuprocide, was likewise the most detrimental to the foliage, but this property was left out of account in the present experiments.

FREAR (D. E. H.). **Chemistry of insecticides and fungicides.**—viii+300 pp., 17 figs., 7 diags., 7 graphs, New York, D. Van Nostrand Company, Inc., 1942.

The text of this book is the outgrowth of the author's lecture notes and reference compilations prepared as the basis for a graduate course in the chemistry of insecticides and fungicides at the State College of Pennsylvania. Part III is concerned with fungicides, chapter X dealing with the copper compounds and XI with those of mercury, miscellaneous fungicides, and wood and cellulose preservatives. Part IV also comprises two chapters: XII describing wetting, spreading, and emulsifying agents, and XIII spray residue removal. Macro- and micromethods of analysis are discussed in part V.

Proprietary products for the control of plant pests and diseases. List of officially approved products.—4 pp., issued jointly by Minist. Agric., Lond., and Dep. Agric. Scotland, 1944.

This first list of proprietary fungicides and insecticides approved by the Ministry of Agriculture and Fisheries and the Department of Agriculture for Scotland under the official approval scheme [*R.A.M.*, xxiii, p. 33], contains six groups of products: A, lead arsenate powders; B, lead arsenate pastes; C, lime-sulphur washes; D, miscible tar oil winter washes; E, stock emulsion tar oil winter washes; and F, organo-mercury dry seed dressings, the last-named group consisting of abavit B, agrosan G, ceresan, harvesan, leytosan, leytosan C. C., lunasan, and Swain's triangle brand. Products in groups other than those shown in the list have not yet become eligible for consideration under the scheme, and will be dealt with at a later date. Further lists will be issued periodically in similar leaflets, and additions to the list made before the next issue will be published in *J. Minist. Agric.*

HERTZ (M. R.) & LEVINE (M.). **A fungistatic medium for enumeration of yeasts.**—*Food Res.*, vii, 6, pp. 430–441, 5 figs., 1942.

Yeasts being of much greater importance than moulds as agents of deterioration in carbonated beverages, it was desirable to evolve a method for the independent determination of the relative incidence of these two groups. At the Iowa State College the writers successfully used for this purpose a malt extract agar medium with an admixture of 100 p.p.m. diphenyl [*R.A.M.*, xxi, p. 13], which exerted a marked fungistatic action for a period of 72 to 96 hours on a large number of moulds, including *Penicillium expansum*, *Mucor hiemalis*, *Aspergillus fumigatus*, and *Fusarium graminearum* [*Gibberella zeae*], while permitting the luxuriant growth of most of the yeasts tested. *Rhizopus nodosus* and *R. nigricans* [*R. stolonifer*], however, proved refractory to the action of diphenyl even at a strength of 500 p.p.m. In the presence of diphenyl a pink yeast failed to produce its pigment, and the mycelium of *A. niger* was of a vivid yellow colour, while conidial development was inhibited.

Wilkowske (H. H.) & Renner (K. M.). **A rapid method of churning cream into butter for mold mycelia determinations.**—*J. Dairy Sci.*, xxvi, 3, pp. 283–287, 1943.

A rapid method of churning cream into butter for mould (*Oospora lactis*) mycelia determinations by the standard methods approved by the (United States) Federal Food and Drug Administration [*R.A.M.*, xx, p. 205 *et passim*] has been developed at the Texas Technological College. It involves churning the cream by means of a malt-mixer and counting the mycelia in the butter thus produced. There were no statistically significant differences between the mould mycelia counts of butter samples churned by the malt-mixer method and those churned in commercial butter plants. The new technique is simple, accurate, and applicable to the study both of mould in cream and in the butter prepared therefrom.

Puck (T. T.), Robertson (O. H.), & Lemon (H. M.). **The bactericidal action of propylene glycol vapor on microorganisms suspended in air. II. The influence of various factors on the activity of the vapor.**—*J. exp. Med.*, lxxviii, 5, pp. 387–406, 2 diags., 2 graphs, 1943.

The bactericidal action of propylene glycol vapour on air-suspended micro-organisms [*R.A.M.*, xx, p. 259] was shown to reach a maximum intensity at a temperature below 80° F. and an atmospheric relative humidity between 45 and 70 per cent. The disinfectant exerted as powerful an effect when dispersed in an 800 cu. ft. room as in chambers of 2 cu. ft. capacity. The minimum propylene glycol concentration required for the destruction of pneumococci was 1 gm. in 20,000,000 c.c. air, while from 1 to 5,000,000 and 1 to 10,000,000 were necessary to produce comparable results on the streptococci and staphylococci.

McComb (A. L.). **Mycorrhizae and phosphorus nutrition of Pine seedlings in a prairie soil nursery.**—*Res. Bull. Ia agric. Exp. Sta.* 314, pp. 582–612, 10 figs., 1943.

During the spring of 1937 the first crops of conifers were seeded at the Iowa State Forest Nursery, which is situated on an O'Neil sandy loam. The species included northern white pine (*Pinus strobus*), ponderosa pine (*P. ponderosa*), Virginia pine (*P. virginiana*), and Japanese red pine (*P. densiflora*), all of which were mulched with pine needles from a vigorous 14-year-old plantation of white and red pines. Other conifers seeded but not mulched with pine needles included red or Norway pine (*P. resinosa*), Austrian pine (*P. nigra*), Douglas fir (*Pseudotsuga taxifolia*), and Norway spruce (*Picea abies*).

By about 1st August it was noticed that the beds mulched with pine needles had a spotted appearance. In certain parts of these beds the seedlings were making vigorous growth, while in others they were stunted. The seedlings not mulched with pine needles were all stunted. The difference between the good and bad places in every bed became progressively more conspicuous. In late September the stunted seedlings began to turn brown or reddish-purple, though the vigorous ones were a normal green. At the termination of the growth period the vigorous seedlings were about twice the size of the stunted ones.

Examination revealed that the vigorous seedlings all possessed abundant ectotrophic mycorrhiza, though the stunted seedlings had few or none. This relationship held for all seedlings from beds mulched with pine straw, and was most marked with Virginia and Japanese red pines. The seedlings from beds of Austrian and red pine, Douglas fir, and Norway spruce, which had not received the needle mulch, were uniformly poor and none showed ectotrophic mycorrhiza.

During the winter many of the non-mycorrhizal seedlings in the mulched beds died. During the second growing season, however, the size of the areas supporting vigorous seedlings increased, and many of the previously unhealthy seedlings

regained their greenness and made good growth. At the end of the second season all save a few of the areas previously showing stunting contained vigorous seedlings. In the beds not originally mulched with pine straw winter mortality was very conspicuous. In the late spring of the second season, however, a few small spots of vigorous seedlings appeared, and these seedlings were found to have mycorrhiza. These spots enlarged slowly, but by the close of the second season about 90 per cent. of the Douglas fir seedlings, and only a slightly lower percentage of the Austrian pine, red pine, and spruce were dead.

To ascertain if the pine needles used to cover the seed-beds were a source of mycorrhizal fungi inoculation of new coniferous seed-beds was attempted. In the spring of 1938 duff and humus-rich top soil were obtained from the plantation which had furnished the pine straw used for the 1937 seed-beds, it having been previously ascertained that the trees in this plantation bore mycorrhiza. This soil was applied at the rate of 1 bush. per 250 sq. ft. of seed-bed, and the bed was then sown to Scots pine (*Pinus sylvestris*). At the end of the second growing season (1939) many of the uninoculated seedlings were dead, while those still alive averaged under 2 in. in height, whereas the inoculated seedlings averaged 7 in. in height.

Inoculation of seed-bed soil with the same duff was attempted for other species, including white pine, jack pine (*P. banksiana*), and Douglas fir, with similar results; in all cases, marked stimulation of growth occurred and mycorrhiza appeared in the inoculated but not in the uninoculated plots.

A study of the nutrient content and root development of mycorrhizal and non-mycorrhizal pines from the State Forest Nursery was made, using Virginia pine stock. This showed that (1) green and dry weights of mycorrhizal plants were double those of non-mycorrhizal; (2) the total height of mycorrhizal plants was 35 per cent. greater, and height growth from cotyledons to bud 60 per cent. greater; (3) mycorrhizal plants were 17 per cent. longer from root-collar to cotyledons; (4) the average mycorrhizal plant had over 600 absorbing short roots and mycorrhizal tips or branches, while the non-mycorrhizal had only slightly over 300; (5) the number of non-mycorrhizal short roots on mycorrhizal and non-mycorrhizal plants was about equal; (6) the extra absorbing root tips on the plants from inoculated soil were thus mycorrhizal and can be regarded as extra root tips formed as a result of the mycorrhizal stimulus; (7) mycorrhizal plants contained (totals per plant) twice as much nitrogen and potassium and four times as much phosphorus as non-mycorrhizal plants; (8) on a percentage of dry-weight basis the seedlings with mycorrhiza contained twice as much phosphorus as non-mycorrhizal plants, but there was small difference in the contents of nitrogen and potassium. These data indicate that mycorrhiza, or the conditions that permit their formation, directly stimulated root growth and activity, and that the plants so stimulated were able to absorb increased amounts of phosphorus, an element which appeared to be limiting growth in this soil.

When conifers were grown on uninoculated soil, good growth followed phosphorus fertilization, though little or no response was obtained with nitrogen. Seedling growth following phosphorus fertilization was about equal to that obtained when unfertilized soil was inoculated with humus-containing mycorrhizal material.

Short roots of white pine seedlings from uninoculated O'Neil soil fertilized with phosphorus, nitrogen, and potassium showed ectotrophic mycorrhiza, and possessed a very compact mantle of fine mycelia. Short roots from seedlings on inoculated, unfertilized soil showed mostly ectendotrophic mycorrhiza with coarse hyphal threads. It is thought that two species of fungi may be involved, one of which may have been subdominant in the original nursery soil and unable to form mycorrhiza without phosphorus fertilization. The author suggests that failure of

non-mycorrhizal pines on O'Neil soil may be due to a low level of root respiration, which may be stimulated by secretions from mycorrhizal fungi and by phosphorus.

STELZNER (G.). **Zur Frage der Virusübertragung durch Samen, insbesondere des X- Y- und Blattrollvirus der Kartoffel.** [A contribution to the problem of virus transmission through seed, especially of the Potato X, Y, and leaf roll viruses.]—*Züchter*, xiv, p. 225, 1942. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 1–4, pp. 58–59, 1943.]

The first part of this study is a compilation of previous reports on the transmissibility of various plant viruses through the seed, while the second is concerned with the experiments of the author and others on the conveyance of the potato X, Y, and leaf-roll viruses by this means. The presence of the X and Y viruses in the potato embryo and their subsequent inactivation on the separation of the seed from the mother plant were already known, and these observations were confirmed by the writer in respect both of potato and *Datura*, embryonic infection in which amounted to as much as 100 per cent. Both viruses lost their infective capacity during the ripening, storage, and germination of the seed. Kausche noticed a similar process of inactivation in connexion with the tobacco mosaic virus in Samsun seed, which he attributes to the influence of a substance produced during maturation and germination.

OSSIANNILSSON (F.). **Bladlöss som spridare av bladrullsjuka på Potatis i Sverige.** [Leaf aphids as vectors of leaf roll disease of the Potato in Sweden.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, viii, 1, pp. 15–16, 1944.

So far only two species of aphids have been experimentally proved to act as vectors of potato leaf roll in Sweden, viz., *Myzodes* [*Myzus*] *persicae* and *Aulacorthum* [*M.*] *pseudosolani* [*R.A.M.*, xxii, p. 446], of which the former occurs in the open as far north as Skellefteå and the latter up to Östersund. The prevalence of the aphids in potato fields in different parts of the country is under investigation.

LARSON (R. H.). **A foliar mottle and necrosis in Chippewa Potatoes associated with infection by a strain of the Potato X virus.**—*Phytopathology*, xxxiii, 12, pp. 1216–1217, 1943.

Attention is drawn to the occurrence on Chippewa potatoes in Wisconsin of a tuber-perpetuated disease somewhat resembling mild mosaic in varieties of the Cobbler and Triumph type, but distinguishable from it by characteristic irregular, chlorotic, mottled patches in the intercostal areas of the upper leaves of young plants and small, scattered, necrotic flecks on the older foliage. The tubers are slightly below normal size but not otherwise affected. The disorder was first observed in 1939, and subsequently in 1941, 1942, and 1943. Infection was mechanically transmitted to the Chippewa, Sebago, Triumph, Red Warba, and Russet Burbank varieties, and to F_1 selfed Katahdin seedlings, the first symptoms appearing in 12 to 15 days as small, irregular, scattered, necrotic lesions penetrating the thickness of the leaf; these were followed, first by a faint, interveinal, chlorotic mottling of the younger leaves, and then by the development of isolated necrotic flecks on the interveinal areas. Seedling 41956 is immune.

Connecticut Havana No. 38 tobacco and *Nicotiana rustica* inoculated with the Chippewa virus contracted well-marked ring-spot symptoms. Tobacco plants previously infected with a mottle strain of the potato X virus did not develop ring spot on reinoculation with the virus from Chippewa plants, thereby strongly indicating that the latter is an uncommon variant of X. Chippewa is highly resistant to mild mosaic and a masked carrier of the common X strains. In preliminary temperature studies the disease assumed a more virulent form at 16° to 20° than at 24° C., and was entirely suppressed at 28°.

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ROBBINS (W. J.) & MA (ROBERTA). **Pseudopyridoxine and certain fungi.**—*Proc. nat. Acad. Sci., Wash.*, xxix, 6, pp. 172–176, 1943.

Continuing their earlier studies [*R.A.M.*, xxii, p. 218], the authors found that *Ophiostoma catonianum*, *Ceratostomella ips* No. 255, *C. montium*, *C. microspora*, *C. multiannulata*, *C. piliferum*, *C. pluriannulata*, and *C. ulmi* responded to pyridoxin as such. The physiological activity of pyridoxin was not replaced by *dl*-alanine. No evidence was obtained from these fungi of the existence of E. E. Snell's more active pseudopyridoxin.

SAMSON (R. W.) & ELLIS (N. K.). **Influence of time of planting of Potatoes in Indiana muck soil on yield and scab development.**—*Amer. Potato J.*, xx, 12, pp. 301–308, 1943.

From 1939 to 1942 the yields of Katahdin, Irish Cobbler, and Sebago potatoes, both total and marketable (in respect of freedom from scab [*Actinomyces scabies*]), were calculated for crops from plantings made at five fortnightly intervals from 5th May to 5th July on a muck soil farm near Walkerton, Indiana.

Total yields decreased with each successively later planting, whereas scab severity rose to a maximum in the third or fourth, except in 1942, when it decreased in the last planting. Thus, the average total yields over the entire period of the tests for the 5th to 6th and 19th to 21st May, 2nd to 5th and 16th to 20th June, and 30th June to 5th July were 365, 327, 261, 170, and 76 bush., respectively, the percentages of marketable tubers for the corresponding dates being 61, 45, 36, 42, and 40, respectively. The incidence of the pitted and superficial types of the disease [*R.A.M.*, xix, p. 111] on Cobblers planted on 22nd May and 6th and 23rd June, 1940, was 11, 15, and 24, and 43, 51, and 53 per cent., respectively.

Further work is in progress to elucidate the factors responsible for variations in the incidence of scab in relation to variety and planting dates under local conditions. Soil moisture is probably of outstanding importance in this connexion, influencing as it does both yield and scab development. In the meantime, planting at the earliest feasible date is evidently one method of reducing the losses from *A. scabies* in the three varieties under observation.

HORSFALL (J. G.) & TURNER (N.). **Injuriousness of Bordeaux mixture.**—*Amer. Potato J.*, xx, 12, pp. 308–320, 2 graphs, 1943.

Bordeaux mixture has been known for some time to reduce potato yields in the absence of pests and diseases [*R.A.M.*, ix, p. 265], and in the present series of tests at the Connecticut Agricultural Station the compound was shown to exert a similar adverse effect on production even in the case of serious depredations by the flea-beetle [*Epitrix cucumeris*]. Hitherto such damage has been masked by the control of the particular pest or disease under investigation, but the writers obviated this difficulty by the application of a method for the separation of the two mutually exclusive effects when operating on the same plots. The method [which is fully described] involves the determination of the graphic relation of

pest or disease attack to yield, and the assessment, by interpolation on parallel curves, of the treated and control plots at equal levels of insect or disease incidence. Using this technique, the yield reductions from Bordeaux spraying at median levels of attack were fixed at roughly 12 and 11 per cent. for flea-beetles on Irish Cobbler and tipburn on Green Mountain, respectively.

It is not proposed that Bordeaux should be discarded, particularly at the present critical juncture, on account of its injurious action on productivity, which may be mitigated by the following precautions: spraying as seldom and starting as late in the season as possible, use of a 'low-strength' formula, e.g., 300 gals. 2-1-50 per acre instead of 100 gals. 8-4-50; and the substitution of dolomitic (magnesium) for high-calcium lime [ibid., xiii, p. 725; xiv, p. 607].

Godoy (E. F.). **Epifitología del 'tizón' de la Papa en la zona papera 'sudeste' de la Provincia de Buenos Aires durante el verano 1940–41.** [Epiphytology of Potato 'blight' in the 'south-eastern' Potato-growing zone of the Province of Buenos Aires during the summer of 1940–41.]—*Rev. Fac. Agron., La Plata*, Ser. 3, xxv (*1940*), pp. 97–139, 3 pl., 2 graphs, 2 maps, 1943. [English summary.]

An outbreak of late blight (*Phytophthora infestans*) of unprecedented severity occurred in 1940–1 throughout the potato-growing region south-east of the Province of Buenos Aires, originating in the coastal districts. The attacks developed at intervals of a few days from 24th December to 24th February and varied in intensity, in some places actually destroying the crops, while in others they assumed a milder form but constituted a permanent focus of inoculum during the season. The source of infection could not be definitely traced, since both local and foreign 'seed' was used for planting.

Analyses of rainfall, incidence of dew and fog, relative humidity, and cloudiness for the period covered by the epiphytotic showed that the conditions laid down by workers in other countries for the intensive development of the pathogen [*R.A.M.*, xiv, p. 715 *et passim*] were amply fulfilled. The so-called 'fog strokes' and 'sunstrokes' are also believed to be forms of potato blight. During the last 33 years there were four authenticated cases and two unconfirmed reports of late blight in the south-eastern zone, the season of 1914–15 having been characterized by an epidemic of comparable severity to the one under discussion. In the 'blight' seasons, the precipitation from December to March was above the normal for the 33-year period, while the rainfall for each month in which the disease was recorded also exceeded the average. The relative humidity during the same seasons was abnormally high, and the summers marked by severe outbreaks were exceptionally cool, the minimum temperature of 16·4° C. having been registered in 1940–1.

The tubers of the Katahdin, Green Mountain, and White Rose varieties were equally susceptible to infection by *P. infestans*, while the foliage of the first-named was more resistant than that of the other two, and the leaves of the European Alma and Arran Consul sustained less severe damage than those of the above-mentioned American sorts. It is estimated that 60 to 70 per cent. of the potential yield was lost through late blight in 1940–1, and the results of spraying experiments with Bordeaux mixture indicated that the control by this means of such a virulent epidemic is difficult, if not impossible.

Small (T.). **The soil as a source of infection of dry rot of Potato.**—*Nature, Lond.*, cliii, 3884, pp. 436–437, 1944.

In 1942, inoculation of susceptible varieties of potato tubers with unsterilized field soil previously sprayed with a spore suspension of *Fusarium coeruleum* caused dry rot development. In the same year and in 1943, soil samples were obtained

from several farms in Cheshire, each consisting of soil scraped from 30 tubers with a sterile knife and placed in a new envelope in the field at digging time, before the tubers contacted any possible source of infection. All the samples were tested by direct inoculation of tubers and found to be infected. Similar results were obtained with many samples collected at random from healthy seed tubers stored in seed boxes in lofts during the winter of 1942–3.

During the winter of 1943–4, soil samples were collected at wholesale stores from seed potatoes imported from Scotland and Northern Ireland. Of 42 such samples tested, 37 were infected. The *Fusarium* species isolated in all this work were not identified, but all produced dry rot on test tubers.

These results prove that the organism or organisms causing potato dry rot are present in field soils in Cheshire and in the soil adhering to imported seed tubers before these are distributed to farmers.

Brown spot of Paddy.—*Trop. Agriculturist*, xcix, 3, pp. 150–151, 1 pl., 1943.

Rice brown spot (*Helminthosporium oryzae*) [*Ophiobolus miyabeanus*: *R.A.M.*, xxi, p. 362] has been present in Ceylon for about 23 years, where, however, it has not hitherto been recorded as causing serious damage. In June and July, 1943, infection reached epidemic proportions in the Uva district, where the 'four-months' varieties Hondarawela, Suduwi, Karayal, Rathkunda, Samba, Perillanel, and Vellai illankalayan were all equally affected. Transplanted rice was more resistant than broadcast sowings. The outbreak appears to have been favoured by wet, humid weather, the presence of sufficient inoculum, and poor growth of the plants.

Seed from affected heads should not be used for sowing. After harvesting, the stubble and chaff should be burnt on the fields. Intensive cultivation of the affected fields is recommended, together with a thorough clearing-up of all weeds and grass. Transplanting should be practised wherever possible.

Wahlin (B.). **Några fall av manganbrist sommaren 1943.** [Some cases of manganese deficiency in the summer of 1943.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, viii, 1, pp. 11–15, 2 figs., 1944.

Hemp on a reclaimed marshland farm in Gothland, Sweden, was observed towards the end of May, 1943, to show signs of manganese deficiency, including arrested growth (20 to 30 instead of 60 cm. in height) and the development on the leaves, beginning with the basal ones, of brown, necrotic spots, which expanded and finally, in conjunction with a spell of dry weather, destroyed the plants. On 11th June a portion of the field was divided into three and treated with (1) manganese sulphate at the rate of 40 kg. per ha., (2) the same plus saltpetre, 100 kg. per ha., and (3) the latter alone. On the 13th 4 mm. of rain fell, and within the next few days a noticeable improvement took place in the condition of the manganese sulphate-treated sections of the field, whereas deficiency symptoms were still apparent on the part receiving saltpetre. Manganese deficiency also affected another hemp crop on a larger field of the same farm, and in this case the adjoining spring wheat [*R.A.M.*, xxiii, p. 129] and white mustard stands were similarly involved. The height of the wheat plants was reduced from 50 to 30 or even 20 cm. in cases of acute shortage, the lower leaves were wilted or dead and the upper ones mottled yellow-green, with necrotic tips. The lack of manganese in the mustard crop was chiefly expressed by partial failure of growth, accompanied in some of the plants by yellow spotting of the foliage. Manganese sulphate was applied with the same beneficial effects as in the smaller hemp crop. The P_H values of the larger field were determined and found to be 5·9 and 6·4 at distances of 30 and 15 m., respectively, from the dyke and 7·4 along the latter, corresponding to acute and moderate shortages and a sufficiency of manganese, respectively.

Dennis (A. C.) & Dennis (R. W. G.). **Boron and plant life—part V. Developments in agriculture and horticulture, 1940–42.**—Reprinted (with addition of bibliography) from *Fertil. Feed. St. J.*, 38 pp., 5 figs., 1 graph, 1943.

In continuation of their earlier work on the subject [*R.A.M.*, xx, p. 322], the authors review 186 papers dealing with boron in relation to plant life published during the years 1940 to 1942.

Ferres (H. M.) & Trumble (H. C.). **Exploratory investigations of soil deficiencies by means of small pot cultures.**—*J. Aust. Inst. agric. Sci.*, ix, 4, pp. 179–182, 2 figs., 1943.

In view of the frequent failures of pasture in the high rainfall areas of South Australia, and the accumulating evidence of response to manganese, copper, zinc, boron, and molybdenum, the authors carried out pot culture tests in 1942 as a preliminary means of investigating large numbers of soils simultaneously under comparable conditions of technical control. Subterranean clover was used as the test plant from March to September and Palestine strawberry clover [*Trifolium fragiferum*] in summer. When evidence had been secured of response to one or more groups of the elements, further tests were conducted to separate the effects of single elements and their interactions. The data obtained are tabulated. The chief value of the method is the rapidity with which a lead is obtained for subsequent field tests.

Marchionatto (J. B.). **La contribución de Carlos Spegazzini a la fitopatología argentina.** [The contribution of Carlos Spegazzini to Argentine phytopathology.]—*Rev. Fac. Agron., La Plata*, Ser. 3, xxv (*1940*), pp. 11–20, 1 fig., 1943.

Spegazzini's numerous contributions to the study of mycology and phytopathology in Argentina are listed, with the addition of critical notes and bibliographical citations.

Gottlieb (D.). **The mechanism of wilting caused by Fusarium bulbigenum var. lycopersici.**—*Phytopathology*, xxxiv, 1, pp. 41–59, 1 fig., 1 diag., 1944.

A dense mycelial growth of *Fusarium bulbigenum* var. *lycopersici* was observed in about half the vessels in the roots and lower stems of wilted tomato plants, but no isolations could be made from the tops of the stems. The wilting of the plants is correlated with the presence of a toxin [*R.A.M.*, xxii, p. 330] in the tracheal fluid. The poisonous substance withstands oxidation, and spectrographic analyses revealed no important differences between the emission-element contents of fluids from diseased and healthy plants. On immersion in distilled water, the wilted plants recover, but loss of turgidity again ensues on their transference to toxic fluids. The toxin interferes with the normal water relations of the host. When the transpiration of seedlings immersed in the toxic tracheal fluids is prevented, wilting does not occur, while seedlings that have already become flaccid regain their turgidity under these conditions.

Swingle (R. U.), Tilford (P. E.), & Irish (C. F.). **A graft transmissible mosaic of American Elm.**—*Phytopathology*, xxxiii, 12, pp. 1196–1200, 3 figs., 1943.

Further inoculation experiments in 1940 and 1941 at Wooster, Ohio, involving the grafting of over 100 healthy American elms with branch, trunk, and root materials from mosaic-diseased trees in the same State, Kentucky, and New Jersey, confirmed previous observations as to the transmissibility of the disorder by this means [*R.A.M.*, xx, p. 237]. The symptomatology of the condition and its communicability to sound trees by the introduction of mosaic patches suggest the agency of a virus, the mode of spread of which in the field is unknown. Attempts

to improve the state of the elms by the application of a fertilizer and the excision of diseased branches have been unsuccessful.

WEBER (G. F.). **Needle rusts of Pine trees in Florida caused by Coleosporium species.**—*Proc. Fla Acad. Sci.*, vi, 3–4, pp. 131–142, 1943.

Needle rusts (*Coleosporium* spp.) have been collected in widely separated localities of Florida over a period of nearly 20 years, and the writer suspects them to be co-extensive with their pine hosts [*R.A.M.*, xix, p. 126]. All the rusts are heteroecious, the pycnidial and aecidial stages being formed on *Pinus* spp. and the uredo and teleuto phases on herbaceous plants, mostly broad-leaved members of the Carduaceae. The ten species of *Coleosporium* investigated were distributed as follows: *C. apocynaceum* on *P. australis*, *P. palustris*, and *P. taeda*, with *Amsonia ciliata* as the alternate host; *C. delicatulum* on the same *P.* spp. and *P. serotina* (*Euthamnia caroliniana*, *E. leptocephala*, and *E. minor*); *C. elephantopodis* on the above-mentioned pines and *P. glabra* (*Elephantopus carolinianus*, *E. elatus*, *E. nudatus*, and *E. tomentosus*); *C. heterothecae* on *P. australis* (*Heterotheca subaxillaris*); *C. ipomoeae* on *P. australis*, *P. palustris*, *P. serotina*, and *P. taeda* (*Colonyction aculeatum*, *Ipomoea carolina*, *I. pandurata*, *I. pes-capreae*, *I. speciosa*, *I. triloba*, *Pharbitis barbegina*, *P. cathartica*, and *P. hederacea*); *Coleosporium laciniariae* on *Pinus australis* (*Laciniaria chapmanii*, *L. elegans*, *L. graberi*, *L. gracilis*, *L. laxa*, *L. pilosa*, *L. scariosa*, and *L. tenuifolia*) [*Liatris* spp.]; *C. minutum* on *P. glabra* and *P. taeda* (*Adelia ligustrina*); *C. solidaginis* does not attack pines in Florida, but is found on *Aster puniceus*, *Chrysopsis scabrella*, *Solidago brachyphylla*, *S. chapmani*, *S. fistulosa*, *S. puberula*, *S. rugosa*, *S. sempervirens*, and *S. stricta*; *C. vernoniae* on all the above-mentioned pines, *P. clausa*, and *P. echinata*; and *C. viguierae*, absent from pines but infecting *Verbesina laciniata*.

The rusts have been observed to cause very heavy damage to seedlings up to 3 ft. in height, but are seldom of importance on saplings or trees. The principal symptom of infection is the appearance of yellow to orange-coloured areas, up to several centimetres in length, on any part of the needle between the fascicle sheath and the tip. The pycnidia may be seen in central Florida any time after early January, being most abundant during the latter half of February. The circular to oval, slightly raised, rounded, smooth, reddish-orange to black structures, 1 to 4 mm. in diameter, develop in single, continuous or intermittent, irregular lines, in several parallel short lines, or in irregular clusters on the yellowish areas, usually all on one side of the needle. Three to six weeks later the aecidia rupture the leaf epidermis opposite the pycnidia. The aecidiospores within the peridial walls are bright orange. On the alternate hosts the symptoms are much less conspicuous, consisting merely of yellow cushion-like areas on the leaves, which may, however, destroy the plants.

The infected herbaceous hosts are the source of summer and autumn inoculum for the pines, and conversely, the aecidial spores from the latter serve to infect the former in the spring. The aecidiospores are very resistant to adverse conditions, travelling long distances without loss of viability, in contrast to the short-lived basidiospores, which usually die within a mile of their original host. The herbaceous hosts are in all cases directly penetrated by the spore tubes, which grow through the epidermis, whereas entry to the pine needles appears to be effected through the stomata. The aecidia appear in the spring following the previous season's infection, usually scattered, though Spaulding (*Phytopathology*, vii, p. 225, 1917) found up to 20 per needle. Less than a month later uredosori develop on the alternate hosts. Invasion of the tissues is not usually extensive, and consequently the yellow areas on the needles are circumscribed.

In order to avoid contact with the alternate hosts of the rusts, pine seed-beds should be located in cultivated sites at a distance from woodlands, roadsides, and

fence rows where the weeds abound. A copper-containing fungicide may be applied to transplanted seedlings where ornamental values are an important consideration.

Reference is made to previous outstanding contributions to the study of *C.* spp., and a revised and abridged version of the portion of Hedgcock's key [*R.A.M.*, vii, p. 603] applicable to Florida is presented. The morphology of the rusts is described.

LEUTRITZ (J.). **Outdoor tests of wood preservatives.**—*Bell Lab. Rec.*, xxii, 4, pp. 179–182, 2 figs., 1943.

Outdoor tests of wood preservatives are now carried out by the Bell Telephone Laboratories as follows. Sticks $\frac{3}{4}$ in. square and 3 ft. long are cut from boards of southern pine sapwood and classified according to density, and for a single treatment with a given concentration specimens are selected which are uniformly distributed throughout a chosen density range. For the full-cell treatment, the specimens are placed in a cylinder, from which the air is then evacuated and after a specified time the preservative is poured in and forced by air pressure into the wood cells. By this procedure about 30 lb. of the disinfectant may be injected per cu. ft. For lower retentions the preservative may be treated with a volatile solvent which evaporates rapidly as soon as the process is completed. For the empty-cell treatment, the pressure of the cylinder is raised from atmospheric to between 25 and 50 lb. The preservative is then pumped in and forced into the wood by a further rise in pressure. On the release of this pressure, the expansion of the initial air entrapped by the preservative forces out the excess from the wood, and theoretically only the cell wall is coated—hence the name, empty-cell treatment. Vacuum is also applied after the release of pressure to empty the cells more thoroughly.

Twenty to 25 sticks are selected for each single charge and laid side by side. They are marked with crayon 7 in. from each end, at the mid-point, and 2 in. on either side of it. Identification tags are affixed and the sample is weighed before and after treatment, the gain on the latter occasion being taken as the basis for calculating the amount of preservative retained. The sticks are then cut at the mid-point line, thus providing specimens treated under identical conditions for comparison by the laboratory rot test (*Bell Lab. Rec.*, p. 324, May, 1938) and field exposures. Some of the latter tests are conducted in New Jersey, but the bulk of the specimens are exposed at Gulfport, Mississippi, where climatic conditions ensure severe rotting practically all the year round. The specimens are buried (usually in the spring) to the 7-in. mark in a uniform distribution throughout the plot. Once a year they are examined and the incidence of decay at and below soil-level rated. Ten denotes a sound condition, while 0 is allotted to the sticks so entirely disintegrated as to be found lying on the ground. The intermediate ratings are used to express the relative amounts of decay or termite infestation, 5 being the critical point at which the specimen can easily be broken in the hands, indicating failure of the particular treatment under investigation.

Since some specimens survive for several years or withstand the exposure tests, a time rating was devised taking their past performance into consideration. At the end of each year's exposure, the average rating for that year of a group of specimens is computed and multiplied by the number of years the sticks have been exposed at that time. After several years of testing, the sum of these products is taken and divided by the sum of the years of exposure. For instance, if the average rating of a group is 9·5 after one years' exposure and 8·3 after two years, the time rating would be 2(9·5+8·3) divided by (1+2).

Preservatives showing promise in laboratory and field tests with small specimens are applied to larger pieces of fence-post size, known as 'stobs', and in the event of favourable results, an experiment on a commercial scale may be warranted

with pole-size timber. For this purpose, 10-ft. posts are cut from poles and exposed in test gardens, where valuable information is obtained on the retention of the preservative by the wood when heated by the sun or leached by ground waters.

Data provided by these accelerated outdoor exposure tests have been of considerable use in the evaluation of both oil- and salt-type preservatives. Perhaps the most encouraging results were obtained with greensalt [*R.A.M.*, xxii, p. 47], which has been used on a limited scale in place of creosote where clean, full-length treated poles were required. Owing to the emergency restrictions now in force on the use of many of the metallic salts, the results of the studies on most preparations of this type cannot be immediately applied.

Fox Wilson (G.) & Green (D. E.). **A simple calendar of control measures against vegetable pests and diseases.**—*J.R. hort. Soc.*, lxix, 4, pp. 104–111, 1944.

The symptoms of some well-known vegetable pests and diseases likely to concern allotment-holders, with appropriate preventive and curative measures for each, are presented in tabular form.

Jones (W.). **Downy mildew disease of Cauliflower seed plants.**—*Sci. Agric.*, xxiv, 6, pp. 282–284, 1 fig., 1944.

Numerous cauliflower plants of the Snowball variety, growing in British Columbia, recently became almost worthless for seed production owing to infection of the curd by *Peronospora brassicae* [*P. parasitica*]. Infection of seedlings in cold frames and of the foliage of plants grown in the field has been observed in many localities, but in 1943 a systemic type of infection, involving the main stems and the curd, occurred in many plants; most of the curd parts were stunted, having failed to elongate into normal inflorescences. A constant symptom was a dark purple discoloration of the surface of the stems of the curd, which often appeared in broad longitudinal streaks. Affected tissues were somewhat shrunken and conidiophores and conidia were generally present on the infected stems and leaflets. The internal tissues showed dark grey, necrotic spots and areas, which were present in the main stems as well as in the stems of the curd. In the Pacific Coast areas of British Columbia, where cauliflowers are grown for seed, losses due to curd rot caused by various factors are often very considerable. The trouble usually occurs when the curd is well developed, but before the floral parts start to elongate.

An experiment was carried out in which small cauliflowers were inoculated out-of-doors in October by placing on the surface and among the inner parts of the curd cabbage leaves bearing conidia. After about three weeks, the surface of the curd assumed a dirty white to brown colour, while the surface and internal tissues of the curd stems were dark purple and dark grey, respectively. The mycelium was found in the terminal tissues and in the stems of the curd. About six weeks after inoculation, the infected end was shrivelled, stunted, and brown, though the curd of the control plants was white, firm, and normal.

It is recommended that cauliflower seedlings should be sprayed in the seed-bed with Bordeaux mixture to which a spreader and sticker, such as calcium caseinate, has been added. Spraying should begin as soon as the first leaves start to develop. Other cruciferous hosts should also be sprayed, or eradicated. If the disease should appear on cauliflower seed plants in the field during the curd stage, they should be dusted with copper-lime dust every 10 days until the floral parts are well developed. Insect pests, some of which act as spore-carriers, must also be checked.

Bennett (C. W.). **Latent virus of Dodder and its effect on Sugar Beet and other plants.**—*Phytopathology*, xxxiv, 1, pp. 77–91, 7 figs., 1944.

Dodder (*Cuscuta californica*), removed from plants of the desert shrub, *Eriogonum fasciculatum*, near Riverside, California, and placed on healthy sugar beets in a

greenhouse at the Citrus Experiment Station, was found to harbour a hitherto unknown virus which induced mottling or necrosis, or both, on sugar beet, Rockyford cantaloupe, White Rose potato, tomato, Early Self Blanching celery, buckwheat, pokeweed (*Phytolacca americana*) [*P. decandra*], *Samolus floribundus*, *Polygonum pennsylvanicum*, *Plantago major*, *Chenopodium murale*, *C. album*, and *Nicotiana palmeri* (temporary vein-clearing only on the last-named). By the use of virus-free dodder, the infective principle was recovered from the following symptomless species: *N. glauca*, *N. rustica* vars. English, Iowa, *pumila*, and *jamaicensis*, Turkish tobacco, and mustard (*Brassica incana*).

No insect vector of the dodder virus is known, but transmission is effected by *Cuscuta californica*, *C. subinclusa*, and *C. campestris*. It is readily conveyed by juice inoculation to *Phytolacca decandra*, on which numerous primary lesions are produced, and with more difficulty to *C. campestris*, *Chenopodium murale*, and sugar beet. In the case of *Cuscuta campestris*, seed transmission occurred to the extent of just under 5 per cent.

The thermal inactivation point of the virus, for which the common and Latin names of dodder latent mosaic virus and *Marmor secretum* n.sp., respectively, are suggested, lies between 56° and 60° C. *P. decandra* juice was infectious at a dilution of 1 in 3,000, the activity of the virus in this medium being lost, however, in 48 hours, and in a shorter period in dried juice, while the dried parts of diseased plants yielded no virus. The passage of the virus through Berkefeld N and W filters was readily accomplished.

Although the dodder virus has not been observed to occur on any crop plant in the field, its destructive potentialities, given the introduction of an efficient vector, should not be disregarded, especially in the cases of cantaloupe and buckwheat, and to a lesser extent, in those of sugar beet, potato, and celery.

MARKHAM (R.). **The isolation of viruses by means of the electrically driven Sharples supercentrifuge.**—*Parasitology*, xxxv, 4, pp. 173–177, 1 graph, 1944.

A method of virus isolation by means of an electrically driven Sharples centrifuge is fully described. It has been used for the sedimentation of tobacco mosaic, tomato bushy stunt, tobacco necrosis, and the recently detected virus on *Atropa belladonna* [*R.A.M.*, xxii, p. 451], and infectivity tests showed that the bulk of the viruses is recovered from the sap of frozen leaves, clarified with disodium phosphate, after three-hour spins.

Report of the Waite Agricultural Research Institute, South Australia, 1941–1942.—84 pp., 2 pl., 1 map, 1943.

Items of phytopathological interest in this report [cf. *R.A.M.*, xxi, p. 124], besides those already noticed from other sources, include the following. The severe and widespread epidemic of wheat stem rust (*Puccinia graminis tritici*, race 34) [*R.A.M.*, xxiii, p. 95] in the abnormally wet season of 1941 was responsible for an estimated loss of 10,000,000 bush. in South Australia. In common with other susceptible varieties, Seewari was badly rusted in 1941, but in 1942 it yielded consistently well in several localities. Two strains of Nabawa × (Riverina × Hope), (38–356) and (39–129), were found to compare very favourably with Warigo [loc. cit.] in country trials in 1942. Both are resistant to stem rust, leaf rust [*P. triticina*], and flag smut (*Urocystis tritici*). Stem rust-resistant crossbreds derived from Kenya C6042 and C6040 were included in replicated experiments in 1941 and 1942; the most promising were Kenya C6040 × Dundee (41–157), Kenya C6040 × Ranee (41–119), and Kenya C6042 × Dundee (40–109). Of the newly acquired wheats from overseas, Frondoza, Frontiera, and Supreza (United States) have shown outstanding resistance to both stem and leaf rusts, but were susceptible to bunt (*Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetida*]) and flag smut. Federation 38

and Baart 38, reported resistant to stem rust in California, were very susceptible to this disease in South Australia in 1941 and 1942; on the other hand, their resistance to bunt was confirmed, and they were further shown to withstand infection by at least one race of *Ustilago tritici*. Ridit, Hussar, Nebred, Oro, and Rio (United States), and the stem rust-resistant Apex, Coronation, Regent, and Renown from Canada proved to be resistant to a collection of several races of *T. caries* and *T. foetida*. Rust-resistant spring wheats from Egypt were tested and good agronomic types possessing additional resistance to flag smut selected for yield trials in 1943. Several Australian wheat varieties, including Bordan, Dundee, Ford, Gluyas, Gular, Rapier, and Totagin, have been found resistant to at least one race of loose smut. A survey made in 1942 revealed the presence of *T. foetida* in six widely separated districts of the State. Two varieties, Rio and Oro, possessing the resistant genes R and T, respectively, have been selected as parents in breeding work. They are, however, susceptible to certain American races of bunt, and a search is therefore being made for varieties resistant to all races. So far, Hope and a durum wheat named Doubbi have shown promise in this respect.

A new flag smut of Wimmera rye grass has been shown to be distinct from similar diseases of wheat and rye. The pathogen, *Urocystis* sp., is capable of infecting its own host, *Lolium perenne*, and *L. rigidum*, but not wheat or rye.

Genetic studies on the inheritance of resistance to barley mildew (*Erysiphe graminis hordei*) have been instituted with a view to locating the six known 'resistant' genes on the various chromosomes. Preliminary tests indicated that race 3 of the fungus [ibid., xvii, p. 807] is present in South Australia [ibid., xix, p. 466].

A die-back of flax, which is most conspicuous when the plants are six to eight weeks old and involves the wilting of the top of the main shoot and a spotting of the lower leaves, was consistently observed in the field on patches of chocolate to dark grey soil, rich in limestone. Similar symptoms were induced in flax plants in water culture solutions by the omission of zinc, and in conformity with this result, the addition of zinc sulphate to the superphosphate drilled in with the seed was found greatly to reduce the incidence of diseased plants, with a corresponding improvement in the stand.

The prolific Punjab variety of flax is very susceptible to certain races of *Melampsora lini*, and attempts are in progress to combine it with the resistant Walsh.

In connexion with a project to determine the part played by fungi in the spotting of oranges stored at 40° F., particular attention was paid to the infection of the rind by *Colletotrichum* [*gloeosporioides*], which was found to occur before picking and to be controllable by appropriate spray treatments. The infection remains latent, however, for some time, and the conditions governing the appearance of the spotting in storage are still under investigation.

The Vetomold tomato variety has proved resistant to the local race of *Cladosporium fulvum* [ibid., xxii, p. 81 *et passim*], and on account of its many other desirable commercial qualities is being tested alongside Early Dwarf Red in the Adelaide market-garden district. In breeding against spotted wilt varieties have been found which are so tolerant of the disease that their productive capacity is not greatly impaired by it.

At least two genes appear to govern the resistance of bean varieties to halo blight (*Phytomonas* [*Xanthomonas*] *medicaginis* var. *phaseolicola*). Disease-resistant selections have been isolated from a Canadian Wonder × Burnley Selection cross.

The tomato spotted wilt virus was destroyed by exposure to a temperature of approximately 46° C. in ten minutes. At 40° it was still active after 30 minutes but non-infective after an hour, whereas the control suspension held at 20° had undergone no inactivation in this time. After two hours' exposure at 35° more

than 99 per cent. of the virus had lost its infectivity. In preliminary tests involving five hours' exposure of potted plants to a temperature of 40°, the concentration of active virus was reduced to 5 per cent. of that in the controls maintained at 20°.

The tomato spotted wilt virus was also inactivated at salicylate concentrations of 0·1 M and upwards at 30°. At 0·04 M the rate of inactivation pursued a logarithmic course for the first two hours, after which the concentration of active virus was reduced below the minimum for infection. Only slight inactivation occurred at 0·03 M. The temperature coefficient for this reaction is very high, the course of inactivation being materially slower at 20° than at 30°.

In connexion with attempts at the isolation of the tomato spotted wilt virus, precipitation was effected and a concentrate obtained by treatment of the infective juice with 25 per cent. ammonium sulphate solution. Difficulties were presented, however, by the inactivation of the virus at the relatively low temperatures developing during centrifuging.

Three diseases of suspected virus origin were recorded for the first time in South Australia, namely, daffodil [*Narcissus pseudo-narcissus*] stripe, blight of Williams' Favourite cherries, and a sectorial grooving of the fruits of Eureka lemons, a similar condition of which has also been observed in New South Wales. Features of the cherry blight were the very rapid withering of leaves and blossoms shortly after flowering and the death of branches, or even of the entire tree. The affected trees had had Napoleon-Beauchamp's Black scions grafted on to them for purposes of interpollination. Experiments are in progress to determine the possibility of transmitting the lemon and cherry diseases by budding or grafting.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xlii, 1, pp. 31–34, 5 figs., 1944.

In Victoria, *Sclerotinia sclerotiorum* causes an important transit and storage disease of carrots, which takes the form of a watery soft rot [*R.A.M.*, xx, p. 195]. The fungus is very widespread locally, and sunflower seed crops play a very important part in its dissemination [ibid., xxi, p. 405; xxii, p. 111], particularly in south-eastern Gippsland. Sunflowers are attacked in the seedling stage, but the disease may occur in mature plants, which produce viable seed before they are killed. The fungus produces its sclerotia in the seed heads of the sunflowers, and as these sclerotia are of the same size, colour, and consistency as the sunflower seeds they are not separated from them during the cleaning process. When the organism has become established in the soil, it is very difficult to eradicate it, because of its wide host range. In the field, it attacks celery, lettuce, French beans, tomatoes, cabbage, cauliflower, potatoes, cucumbers, and sunflowers, while in storage it infects nearly all vegetables except onions and potatoes. Under field conditions, it is favoured by cool, moist conditions. In southern Victoria it is most destructive in spring, early summer, and late autumn; in northern Victoria it may also occur in winter.

Experiments showed that healthy carrot roots were rotted completely in five days after being placed in contact with diseased ones.

To minimize losses, growers should avoid growing carrots in fields that have produced infected crops of any kind, particularly sunflowers. Clean cultivation must be practised, and weeds kept down. All injured and diseased roots must be discarded when bagging, and wet roots must not be bagged.

Under local conditions, oats are more widely affected by loose smut (*Ustilago avenae*) than by covered smut (*U. levis*) [*U. kolleri*]; the varieties Burt's Early, Frazier, Fulghum, Kanota, Kareela, and Myall have been claimed to be resistant to both.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lv, 2, pp. 60–64, 5 figs., 1944.

Late blight of potatoes [*Phytophthora infestans*] first appeared in New South Wales in 1909, and by 1911 had spread over the whole of the potato-growing areas of the State. Spraying was introduced, and was adopted by many growers; the practice was maintained for some years in the Hunter River and Clarence River districts, but a succession of dry seasons and a decline in the losses due to the disease led to its abandonment. In 1943, heavy losses were sustained from the disease in the spring-planted coastal areas, which could have been prevented by spraying. The autumn-sown crops in these districts are likely to become infected, should the season prove wet, owing to the presence of large numbers of diseased potatoes that were discarded as a result of the spring outbreak. The problem of spraying largely resolves itself into one of providing suitable equipment. About 100 gals. of spray per acre should be used at each application.

Onion purple blotch [cf. *R.A.M.*, xx, p. 153] was favoured by moderately high temperatures. The causal fungus attacks the leaves and seed stalks, producing greyish lesions which enlarge, darken at the centre, and finally become purplish with concentric light and dark zones. The greyish portion may spread all round the leaf or stalk, stalks so affected falling over and dying. In the bulb crop the disease seldom causes losses, though it may kill the leaves and pave the way for bulb rots. The heaviest losses occur in the seed crop. Spraying has no effect. A crop which has become affected in the first season should not be used for seed. Bulbs for the seed crop should be grown from seed dipped in water at 122° F. for 25 minutes before sowing, and the seed-bed and the crop should be situated on new land or land which has not grown onions for several years; both the bulb and seed crops should be isolated as far as possible from other onions.

Washington Navel oranges and grapefruit in the coastal areas should be sprayed with Bordeaux mixture (3–3–80 plus ½ gal. white oil) in early autumn to control sooty blotch [? *Leptothyrium* sp.]. Lemons should be treated with Bordeaux mixture (6–4–100 plus ½ gal. white oil) against scab [*Sphaceloma fawcettii scabiosa*: ibid., xvi, p. 169; xx, p. 571], the spray being applied as soon as possible after half the petals have fallen.

To ensure good germination, pea seed should be dusted with spergon at the rate of 2 oz. per bush. This material was found to be very suitable where the seed was drilled in, owing to its good lubricating qualities, which assisted the free running of the drill, without clogging or cracking the seed. Satisfactory results are also given by the copper oxychloride dusts, cuprox, oxycop, bunticide, smutol, and soltosan, used at the rate of 2 oz. per bush., and by agrosan or ceresan, used at 1 oz. per bush.

Viljoen (P. R.). **Report of the Department of Agriculture and Forestry and of the Food Control Organization for the year ended 31 August, 1943.**—*Fmg S.Afr.*, xix, 216, pp. 131–201, 1944.

Among the very brief references to plant pathology in this report (p. 199) are the following items. Owing to seasonal conditions, peach curly leaf [*Taphrina deformans*], peach and apricot freckle [*Cladosporium carpophilum*], vine anthracnose [*Elsinoe ampelina*], and powdery mildew [*Uncinula necator*] were exceptionally severe in South Africa. Near Upington, sultanas were affected by a serious leaf disease caused by a hitherto unknown fungus. Close planting appeared to control tobacco kromnek [tomato spotted wilt virus]. Numerous groundnut varieties and crossings were tested for resistance to rosette [*R.A.M.*, xxi, pp. 4, 65], but all were susceptible. Inspection of citrus orchards for psorosis was continued, and of nearly 460,000 trees examined 972 or approximately 0·2 per cent. were found diseased.

WIEHE (P. O.). **Division of Plant Pathology.**—*Rep. Dep. Agric. Mauritius, 1942*, pp. 9–10, 1943.

During the period under review [cf. *R.A.M.*, xxii, p. 10], previous observations regarding the commercial resistance of the M.134/32 sugar-cane variety to red rot [*Colletotrichum falcatum*] were in general confirmed, though in an unusually severe outbreak of the disease at the Riche-en-Eau estate a reduction of 20 per cent. in the yield was sustained. M.72/31 was found to be more susceptible to red rot than it originally appeared.

In July, 1941, B.H. 19/12 sugar-cane cuttings from two localities, one (Forbach) infested by smut (*Ustilago scitaminea*) and the other (Réduit) virtually free from the disease, were planted alternately in four holes in 60 plots and their subsequent development watched. By the following December, 20 cuttings from the former source had contracted infection, and by May the total had reached 28, compared with only five from the healthy region (three in March and two in May). The early appearance (commencing in October) of smutted stools from the Forbach material suggests that it was already diseased at the time of planting, the later cases in both lots being probably due to secondary infection.

Sixteen citrus plants suffering from foliar chlorosis and die-back of the twigs were uprooted, and over half the roots in all of them were found to be dying or dead. Out of 64 cultures of root sections on Wilbrink's agar, 50 tubes yielded species of *Fusarium*, inoculations with which on sour orange seedlings, however, yielded negative results.

Sisal leaves on a Black River estate bore yellowish-white patches enclosing circular areas of normal green tissue; the discoloured portions ultimately dried out into shrivelled, chocolate-brown lesions. The disease, which broke out suddenly in several fields, and was subsequently observed at Grand Bay, in the north of the Island, is tentatively attributed to climatic conditions.

REICHERT (I.). **Plant disease research in war-time.**—*Hameshek Hahaklai*, v, 12, pp. 5–7, 1943. [Hebrew.]

As a result of war conditions, the citrus groves in Palestine have been allowed to fall into neglect, and vast losses have resulted. The two principal troubles are anthracnose [*Colletotrichum gloeosporioides*] and *Diplodia* diseases [? chiefly *D. natalensis*: *R.A.M.*, xx, pp. 13, 111]. Citrus fruits are mainly affected by mould [*Penicillium italicum* and *P. digitatum*] and *D.* [*natalensis*], which were controlled by dipping in disinfectant solutions or the use of wrappers impregnated with diphenyl [ibid., xxi, p. 13].

'Mal secco' disease of lemons [*Deuterophoma tracheiphila*: ibid., xx, p. 398] is spreading in Palestine, largely because control is not undertaken when the condition is first seen. In its early stages it can be eradicated by drastic pruning and the removal of infected material. The Interdonato and Monachello varieties are resistant [ibid., xvii, p. 521; xviii, p. 245], have given good-quality fruit, and are free from the disease. At Rehovoth, trees were infected, but recovered after pruning. Scions of these varieties will be made available. Psorosis [ibid., xx, p. 359; xxi, p. 449; xxii, pp. 62, 63] has spread on Valencia orange and grapefruit trees.

Littauer and Zimmermann found that healthy potatoes can be grown from healthy seed in Palestine provided that plants are constantly rogued to eliminate virus diseases. The autumn crop, sown in August or September, can be lifted in November or December. With Up-to-Date and Arran Banner, the dormancy period is so long that tubers lifted in November are not normally fit for sowing in February. If, however, their dormancy is broken by heating or ethylene chlorhydrin treatment, they can be sown in February. In this way, three generations can be grown in one year. In rainy winters, such as that of 1942–3,

Phytophthora [*infestans*] reaches epidemic proportions. Spraying with Bordeaux mixture and perenox increased the yields two- to threefold and markedly improved their grade composition. Powdery mildew [? *Erysiphe cichoracearum*, ibid., xx, p. 380], which has become widespread during the past two years, was controlled by sulfinette [ibid., xi, p. 494] and cita Californian spray.

Cucumbers are affected by downy and powdery mildews [*Pseudoperonospora cubensis* and *E. cichoracearum*, respectively]. Palti has ascertained that under local conditions treatments (sulphuring against powdery mildew and spraying with Bordeaux mixture against downy mildew) must be applied at intervals of four days to secure control. Bordeaux mixture injured the plants, while perenox and cupro-green did not, and increased the yields up to 70 per cent., also extending the picking period until late summer.

The cultivation of broad beans had been discontinued because of attacks by rust [*Uromyces fabae*] and chocolate spot [*Botrytis cinerea*], but experimental spraying with perenox gave such good control that yields were increased by 60 per cent.

Carrots are attacked chiefly by powdery mildew [? *Oidium* sp.] and blight due to *Macrosporium* [*carotae*]; sulphur treatment controls the former, while the latter, which caused severe losses in many areas in the spring of 1943, can be checked by copper sprays.

The root disease of apples caused by *Polyporellus* [*rhizophilus*] and the trunk disease due to *Dothiorella* sp., have spread considerably since the outbreak of war. Two applications of sulfinette and cita Californian spray prevented the premature defoliation of stone fruit trees by rust [*Puccinia pruni-spinosae*, see below, p. 262]. Vines suffered heavy losses from powdery mildew [*Uncinula necator*] all over the country and from downy mildew [*Plasmopara viticola*] in the coastal plain. Experimental evidence clearly showed that the correct timing of sulphur applications against *U. necator* is essential for their success; treatments should precede the appearance of the disease.

Clover fields dried up or rotted as a result of attack by leaf diseases, particularly *Ascochyta* leaf spots [mainly *A. trifolii*], and by stem and root troubles due partly to *Fusarium* sp. and partly, it is thought, to adverse soil conditions.

FAWCETT (G. L.). **Departamento de Botánica y Fitopatología.** Ex *Memoria anual del año 1942*. [Department of Botany and Phytopathology. *Ex* Annual Report for the year 1942.]—*Rev. industr. agríc. Tucumán*, xxxiii, 4–6, pp. 63–65, 1943.

This report [cf. *R.A.M.*, xxi, p. 481] contains the following items of phytopathological interest. Sugar-cane smut [*Ustilago scitaminea*] has spread all over Tucumán [ibid., xxiii, p. 150], causing an average infection of 5 to 10 per cent. In P.O.J.36, however, the losses have been really serious, necessitating the replanting of certain fields.

In connexion with the prevalent vine anthracnose attributed to *Sphaceloma ampelinum* [*Elsinoe ampelina*: ibid., xxii, p. 236], the absence of the characteristic red halo round the lesions on the grapes casts a slight doubt on the exact identity of the pathogen, the growth of which in culture, however, was typical of the species.

As in previous years, chick peas [*Cicer arietinum*] were affected by a malady involving the decay of the tap-root tips and the desiccation of the plants without producing seed. In 1942 the normal planting date was postponed on account of the severe winter weather, with the result that the crop was attacked while still green and in full flower. A species of *Pythium* was found in the soil underlying the diseased patches, but is not thought to cause the disease. The true source of the trouble is likely to be either in the nature of the soil or in the water relations of the subsoil.

Mosaic is the most destructive disease of potatoes. In an experiment in which

aphids (*Myzus persicae*) were placed on a healthy plant protected from access by other insects, the plant itself shrivelled without developing the characteristic symptoms, which appeared, however, on the new shoots arising from the tubers. Seed imported from the Province of Buenos Aires usually produces healthy plants, but in 1942 it gave rise to many diseased ones.

Verticillium albo-atrum, the agent elsewhere of a cotton wilt, is responsible in Tucumán merely for a chestnut-coloured spotting of the leaves, which are subsequently shed except for the youngest. Fibre production is not noticeably impaired.

Principales enfermedades de origen parasitario que fueron objeto de consulta en el semestre Julio–Decembre de 1942. Principales enfermedades fisiogenicas que fueron objeto de consulta en el semestre Julio–Decembre de 1942. [The principal diseases of parasitic and physiogenic origin which were the subject of consultation during the half-year July to December, 1942.]—*Bol. Sanid. veg., Santiago*, ii, 2, pp. 152–155, 1943.

The following were among the parasitic and physiogenic diseases on which the phytopathologists of the Chilean Ministry of Agriculture were consulted during the period from July to December, 1942 [cf. *R.A.M.*, xxii, p. 470]: *Ascochyta cherimoliae* on *Annona cherimolia*, *A. pisi* on peas, *Alternaria brassicae* var. *nigrescens* [*A. cucumerina*] on watermelon, *A. solani* on potato, *Bremia lactucae* on lettuce, *Cladosporium carpophilum* on plum, *Coryneum beijerinckii* [*Clasterosporium carpophilum*] on peach, *Colletotrichum gloeosporioides*, *Penicillium digitatum*, and *P. italicum* on lemon and orange, the former also sustaining foliar scorch from Bordeaux sprays, *C. lindemuthianum* on bean, *Cycloconium oleaginum* on olive, *Venturia pirina* on pear, *Dendrophoma marconii* on hemp, *Melampsora lini* on flax, *Mycosphaerella fragariae* on strawberry [*Fragaria chiloensis*], *Peronospora trifoliorum* on lucerne, *Phytomonas* [*Bacterium*] *tumefaciens* on vine and plum, *Podosphaera leucotricha*, *Sphaeropsis malorum* [*Physalospora obtusa*], and bitter pit on apple, *Rhizoctonia* [*Corticium*] *solani* on Monterey pine (*Pinus radiata*) seedlings, and *Taphrina aurea* on poplar.

Posnette (A. F.). **The diagnosis of swollen-shoot disease of Cacao.**—*Trop. Agriculture, Trin.*, xxi, 3, pp. 56–58, 1944.

After pointing out that earlier accounts of cacao swollen shoot [*R.A.M.*, xxiii, p. 6] failed to give a complete picture of the symptomatology of the disease because they omitted to take into account the presence of different strains of the virus and overlooked the basis of the pattern in the leaf chlorosis, the author gives a description (which is not claimed to be full or final) of the symptoms collectively; a great deal of the variation presented by the symptoms is due to a corresponding variation in the virus. In this respect, as in the symptoms themselves, the disease presents a remarkable parallel to the peach mosaic complex in North America.

The principle underlying all the leaf chlorosis symptoms of the strains studied appears to be vein-clearing. As a rule, this appears as white flecks, before the leaf changes from pink to green. As the pink fades, other areas become defined, which later are almost transparent or pale yellow, but which retain the pink pigment longer than the rest of the leaf, a pink mottle thus developing on a pale green background. This mottle generally forms a network, marking the veins. As a rule, some transparent streaks are also visible, representing veins from which the pigment has cleared. As the chlorophyll develops and the leaf hardens, the final pattern of the yellow mosaic is formed. This varies with the virus strain and the lapse of time between infection and the development of the leaf.

If flushing occurs four to six weeks after infection, only a few tertiary and smaller veins are cleared, and spots or L- or T-shaped streaks result. If flushing is long delayed, secondary veins may also be cleared, but this is generally a later symptom

that develops on flushes subsequent to that showing the first sign of infection. Usually, the later the stage of infection when the flush develops, the fewer and larger are the cleared areas. The 'feather stage', when the mosaic pattern follows the primary veins and resembles a feather, would seem to indicate that infection has taken place nine to twelve months previously. Subsequent flushes do not always show mosaic, but, with virulent strains, the leaves are nearly always small and pale, and few to a flush.

In all experimental transmissions the mosaic pattern remained fixed until masked by the general yellowing of an old leaf. In most instances, the mosaic is most conspicuous in a young leaf and gradually fades as the leaf ages. Mosaic was never seen to appear after a leaf had hardened; the only symptoms observed in leaves formed before infection was a premature yellowing.

The virus often causes a crinkle, the areas between the main veins bulging dorsally, so that the leaf develops a wavy edge. Sometimes the whole leaf is puckered up. In other cases, large areas die between the main veins, which become drawn closely together, twisting the leaf. The interveinal areas may turn brown and fall out. This necrosis may occur at the edge or tip of a leaf. With all virulent strains, a common symptom is decrease in leaf size. In many affected plants, this dwindles progressively with each flush, until new leaves are less than one quarter the normal area. The period when the leaf changes from pink to green is critical; the leaf may wilt, whiten, and fall.

The development of dwarfed, rounded pods seems to be restricted to the most virulent form of the disease. Unripe pods may show a dark green mottle, but this mottling is pink if developed in direct sunlight. As the pod ripens, the mottle turns green or yellow, disappearing as the pod becomes fully ripe. This was the first sign of infection in transmission experiments with bearing trees. As the pod is growing continuously it immediately becomes affected by the virus, whereas a new flush has to develop before the leaf symptoms become visible.

No small swelling on the stem bearing signs of insect attack should be regarded as diagnostic. Short internodes are a symptom, but are also often due to psyllid infestation. An infected tree usually flushes later than healthy ones in the vicinity; it may miss one flush, and can be detected by the absence of green wood at the branch tips and the presence of numerous old, lichen-covered leaves. Die-back is a symptom of virulent strains.

The only known root symptoms are swellings, generally on the tap-root of seedlings and young saplings and on the main laterals of older trees. No abnormalities have been noted in the flowers.

VALLEGA (J.). **Especialización fisiológica de Puccinia graminis tritici en Brasil.** [Physiologic specialization of *Puccinia graminis tritici* in Brazil.]—*An. Inst. fitotec. Santa Catalina*, iii, pp. 29–36, 1 fig., 1941. [English summary. Abs. in *Exp. Sta. Rec.*, xc, 3, pp. 349–350, 1944.]

Physiologic races 15, 17, and 42, especially the first, of *Puccinia graminis tritici* were found to be widely distributed in the wheat-growing region of Brazil. The same races, together with 11, are likewise very prevalent in Argentina and Uruguay [*R.A.M.*, xxi, p. 188]. Since the appearance of new races of the rust is not very frequent in these South American countries, the breeding of varieties resistant to the four in question offers considerable promise of control.

LIVINGSTON (J. E.) & KNEEN (E.). **A rag-doll technique for the inoculation of Wheat with bunt (Tilletia levis).**—*Phytopathology*, xxxiv, 1, pp. 124–128, 1 fig., 1944.

Duddleston's rag-doll method of inoculation (*Bull. Purdue agric. Exp. Sta.* 236, 1920), modified by the omission of the paper round the cloth, was found to be particularly well adapted to studies at the Nebraska Agricultural Experiment

Station involving the germination and artificial infection of Ceres wheat with bunt (*Tilletia levis*) [*T. foetida*] under uniform conditions. High percentages of disease (up to 95·5) were secured by pre-germination of the spores in rag dolls, followed by the addition of soaked wheat seed-grain to the same dolls on the appearance of primary sporidia. Seven to ten days at 10° C. were requisite for the adequate germination of the spores, succeeded by a 10- to 14-day period at the same temperature to permit the production by the germinating wheat of sprouts about 30 mm. in length: at this size the seedlings could easily be transplanted into sand or soil. The presence of chlorotic spots on the leaves served as a preliminary criterion of the extent of infection by *T. foetida*, though this feature was sometimes indicative of other pathological conditions.

Potapov (A. I.), Soukharev (A. A.), & Chelpanova (Mme A. I.). К вопросу о биологии **Tilletia tritici.** [Concerning the biology of *Tilletia tritici*.]—*J. bot. U.R.S.S.*, xxviii, 3, pp. 110–116, 1943. [French summary.]

In a study conducted in Siberia with *Triticum vulgare* var. *ferrugineum*, the authors found that under the influence of infection by *Tilletia tritici* [*T. caries*: *R.A.M.*, xxi, p. 519], the length of the ear remained unchanged, being 5·605±0·0421 cm. in healthy plants as against 5·725±0·0489 cm. in infected ones; the number of grains was larger in the infected ear than in the healthy one, 28 as against 24; the healthy grain was longer than the diseased, 5·695±0·0449 mm. as against 4·765±0·0823 mm.; and also thicker, 2·897±0·0212 mm. as against 2·3108±0·0327 mm.; and the weight of healthy grains, 21·725±0·435 mg., considerably greater than that of diseased ones, 9·266±0·1861 mg. In plants of the var. *lutescens* grown in the same field the average weight of healthy grains was 34·578 mg. as compared with 11·159 mg. in those infected with *T. caries*. The average weight of the grain coat in healthy plants exceeded that of infected ones by 1·595 mg. in var. *ferrugineum* and by 1·596 mg. in var. *lutescens*, the loss in weight due to infection amounting to 67 and 55 per cent., respectively. The loss of nutritive substance in grain in the presence of spores of *T. caries* was found to amount to 56 per cent. of that of healthy grain for var. *ferrugineum* and 68 per cent. for *lutescens*. The weight of bunt spores contained in one grain was on the average greater in *lutescens* (9·859 mg.) than in *ferrugineum* (8·511 mg.). In mixed samples of grain from the Irkutsk district, the number of bunt spores per gm. was 141,000,000, the weight of spores in one infected grain was 0·01037 gm., and from these figures the number of bunt spores in one infected grain was calculated as being 1,462,170; in mixed samples of grain from the Biysk district the corresponding figures were 174,000,000, 0·01173 gm., and 2,041,020. The specific weight of bunt spores in grains from Irkutsk was 1·26. In germination tests, sufficient air circulation, a moderate humidity, and the presence of oxygen were found essential. The spores of *T. caries* exhibited a high degree of resistance to frost, not only when dry but also when swelling or actually in the process of germinating. Alternate freezing and thawing of moist spores retarded their germination considerably, the first germ-tubes appearing on the 16th day, and the first falciform conidia and the mycelium on the 23rd.

Vallega (J.) & Cenoz (H.). **Reacción de algunos Trigos a las razas fisiológicas de Erysiphe graminis tritici comunes en Argentina.** [Reaction of some Wheats to the physiologic races of *Erysiphe graminis tritici* common in Argentina.]—*An. Inst. fitotec. Santa Catalina*, iii, pp. 45–58, 1941. [English summary. Abs. in *Exp. Sta. Rec.*, xc, 3, p. 350, 1944.]

During the three years previous to the date of writing, severe attacks of powdery mildew (*Erysiphe graminis*) were observed on wheat in Argentina, where the disease, though common, is not ordinarily of economic importance. Tests of

collections from several localities revealed the presence of at least three physiologic races, easily differentiable on the Chul and Sonora varieties and apparently distinct from those described from the United States and Germany. All the varieties widely grown in Argentina proved to be susceptible to the mildew races. The new variety Klein 157, besides several selections from Hope × Lin Calel, was moderately susceptible, whereas one selection from Riccio × Lin Calel showed high resistance. Of the foreign wheats tested, Normandie, Axminster, and a Russian selection were immune, and should therefore be valuable for breeding, especially the first-named, which is also resistant to leaf rust [*Puccinia triticina*]; Hope, Regent, and Renown Selection R.L. 716·6 showed moderate resistance. All strains of *Triticum durum*, *T. polonicum*, *T. turgidum*, *T. spelta*, *T. macha*, and *T. compactum* tested were susceptible, and those of *T. timopheevi* immune, while *T. monococcum*, summer wheat, and *T. dicoccum* comprised both susceptible and resistant forms.

Soukhov (K. S.). Получение очищенного белкового препарата вируса мозаики озимой Пшеницы. [The isolation of purified winter Wheat mosaic virus protein.]—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxxix, 2, pp. 72–73, 1943.

Examination of wheat plant tissue infected with the virus of winter wheat mosaic and treated with solutions of acids or acid salts at P_H4 or with acid fixatives, revealed the presence of numerous needle-like crystals identical with those previously found in juice extracted from mosaic-diseased leaves and in the intestines of the vector, *Deltocephalus striatus*, in acid media at P_H4 [*R.A.M.*, xx, p. 522]. The crystals were present only in the cells of the parenchyma adjacent to the vascular bundles. In these cells deterioration or sometimes complete disappearance of plastids could be observed. A purified preparation of the virus was obtained by macerating diseased wheat leaves in a small quantity of 0·1 per cent. soda solution, filtering the extract from this pulp through Seitz asbestos disks, and adding, carefully and slowly, a small quantity of N/10 acid salt solution to the clear filtrate. At the point of contact between the filtrate and the acid solution a white film formed, consisting of needle-like crystals. On the test tube being shaken repeatedly, the filtrate became cloudy; at P_H approximately 4, a dense, brownish precipitate of crystals was obtained after short centrifuging. Micro-chemical reactions proved the protein nature of the crystals. No inoculation experiments could be carried out at the time, so that the identity of the protein with the virus, though very probable, could not be established. The mosaic disease of winter wheat is considered to belong to the 'yellows' group.

During 1941, Soukhov, Vovk, and Mme Alekseeva are stated to have obtained pure preparations of the virus causing pseudo-rosette of cereals by the above-mentioned method (results unpublished). The two viruses can be distinguished by the following characteristics, in addition to those already known [ibid., xxiii, pp. 210–213]. The winter wheat mosaic virus forms numerous crystals when leaves are macerated in a N/10 solution of acid salt but only a few when they are macerated in water, and its purified preparation can be preserved only at P_H 4; the virus of pseudo-rosette forms crystals when leaves are macerated in water but none when in a N/10 solution of acid salt, and its purified preparation can be preserved only at P_H 5.

Vallega (J.). **Razas fisiológicas de Puccinia graminis avenae halladas en Argentina.** [Physiologic races of *Puccinia graminis avenae* collected in Argentina.]—*Rev. Fac. Agron., B. Aires*, x, 3, pp. 517–529, 1 fig., 1943. (Issued 1944.) [English and Portuguese summaries.]

Between 1939 and 1941, physiologic races 3 and 7 of *Puccinia graminis avenae* were found in three provinces of Argentina, viz., Buenos Aires, Santa Fe, and Córdoba. All the indigenous and Uruguayan oats tested were very susceptible to

both races, but the following foreign varieties, and several hybrids derived therefrom, were resistant: Rainbow, Richland, Iogold, Green Russian, and Hawkeye. A certain degree of susceptibility to the rust was shown by the grasses *Dactylis glomerata*, *Poa bonaerensis*, *P.* aff. *lanigera*, *P. iridifolia*, *Bromus hordeaceus*, *Briza triloba*, *Phalaris minor*, and *P. angusta*.

VALLEGA (J.). **Especialización fisiológica de Puccinia coronata avenae, en Argentina.** [Physiologic specialization of *Puccinia coronata avenae* in Argentina.]—*An. Inst. fitotec. Santa Catalina*, ii, pp. 53–82, 3 figs., 1940 [? after 1941]. [English summary. Abs. in *Exp. Sta. Rec.*, xc, 1, p. 63, 1944.]

Physiologic races 1, 45, 55, and 56 of oats crown rust (*Puccinia coronata avenae*) were comprised in the 137 samples collected between 1939 and 1941 in Argentina [*R.A.M.*, xxi, p. 184]. The principal common feature of the four races was their high degree of virulence to the differential varieties Green Russian, Hawkeye, Anthony, Sunrise, Green Mountain, White Tartar, Appler, Sterisal, and Belar: they were separable, however, on the basis of their pathogenicity to Ruakura, Bond, and Victoria. Race 1, which predominates in Canada, the United States, and Mexico, was likewise found to be more prevalent than the other three in Argentina. Of the native and foreign varieties tested for their reactions to the four races, only Glabrota was resistant to all, and this derivative from *Avena strigosa* offers little practical interest.

No evidence of differences in the reaction to crown rust of seedling and adult plants was afforded by field observations. In the vicinity of Buenos Aires the uredospore stage persists throughout the year; in the summer it has been found on 'volunteer' and wild oats plants, which are believed to assist materially in the propagation of the rust. The four above-mentioned races of *P. coronata* have also been isolated in Argentina from *A. fatua* and *A. sterilis* vars. *ludoviciana* and *macrocarpa*. Among other Gramineae tested, *Lolium* and *Bromus* spp. and *Amphybromus scabrivalvis* proved resistant, a few plants each of *Dactylis glomerata* and *Poa annua* reacted divergently, and *Phleum pratense* was susceptible to race 1 only. These grasses would therefore appear to be of little importance in the spread of crown rust, except as possible reservoirs of infection.

DENNIS (R. W. G.). **Seed-borne diseases in Scottish seed Oats.**—Reprinted from *Scot. Fmr, 24th July, 1943*, 7 pp., 1943.

With a view to ascertaining the state of health of the seed oats being marketed in Scotland, 261 random samples of seed from the 1942 crop from all over the country were examined at the Seed Testing Station of the Department of Agriculture for Scotland. One hundred seeds from each sample were sown in sterile sand at a depth of about 2½ in., to be dug up and washed for examination when the second leaf was showing. The results showed that the maximum amount of infection with the leaf stripe fungus, *Helminthosporium avenae* [*R.A.M.*, xxii, p. 473], including the pre-emergence blight, was 42 per cent. and the average 11·55 per cent., altogether 87 samples, or 41 per cent., of those tested having only 5 per cent. or less infection. A surprising feature was the large amount of seedling foot rot (maximum 80·00 and average 21·04 per cent.) (i) of a severe type, where the stem shrivelled up from the seed upwards beyond the first node, the leaves turned yellow, and the plant usually died; and (ii) of a mild type, where only the part of the stem below ground was affected. From the foot-rot lesions two species of *Fusarium*, *F. nivale* and *F. culmorum*, were isolated. In infection tests with oat seeds (variety Victory) inoculated with various *Fusarium* spp., it was found that both indoors and out the fungi were far more destructive in sand than in soil, possibly owing to excess moisture in sand cultures. This would indicate that oats sown in wet sand may suffer considerable losses due to rotting of the seed by

Fusarium spp. *Gibberella zeae* was not pathogenic to oats in soil and sand out of doors, and only feebly pathogenic at the higher temperature in the laboratory. It is concluded that under Scottish conditions *F. nivale* may cause serious losses, *F. culmorum* is likely to be less destructive except where soil temperatures are high or conditions are unfavourable to the growth of the plant, and *G. zeae* is of little importance. The data from three farm tests with seed previously examined in the laboratory indicated that disinfection with organo-mercury may offer some protection against rotting fungi in the soil during germination, which is the period when *Fusarium* spp. and similar soil fungi are most likely to cause injury. The results of this study lend support to the official view that all cereal seed should be dressed with an organo-mercury disinfectant before sowing.

TERVET (I. W.). **The relation of seed quality to the development of smut in Oats.**—*Phytopathology*, xxxiv, 1, pp. 106–115, 1944.

Plants from seed lots of Anthony, Gopher, Rusota, Iogold, and Black Mesdag oats from different parts of Minnesota were tested in 1940 and 1941 for resistance to *Ustilago levis* [*U. kolleri*] and *U. avenae* [*R.A.M.*, xx, p. 568]. The variation in smut incidence between plants from different seed lots of the same variety was found to be equal to that occurring between the several varieties. For instance, the percentage of infection by *U. avenae* in Anthony in 1940 ranged from 2 to 40, the corresponding figures for Gopher, Rusota, and Iogold being from 0 to 20, 1 to 20, and 0 to 26, respectively. In 1940 the percentages of infection by *U. kolleri* on the same four varieties ranged from 14 to 72, 2 to 50, 1 to 14, and 0 to 21, respectively, and in 1941 on Anthony and Gopher from 18 to 89 and 4 to 51, respectively. In 1941, the incidence of *U. kolleri* on Anthony and Black Mesdag plants from seed lots originating in seven States of the Union and one (Alberta) in Canada ranged from 49 to 83 and from 7 to 60, respectively. The discrepancies in the amount of smut between the various lots are attributed to modifications in the seed resulting from the particular environmental conditions under which the several samples were produced, rather than to genetic differences in the constitution of the plants.

When seed lots were dehulled and inoculated by dusting dry chlamydospores on the naked caryopsis, smaller (though still significant) differences in smut incidence were recorded than by the use of the partial-vacuum method. One sample of Anthony, inoculated by the latter technique, produced plants with only 19 per cent. smut compared with 61 in a lot subjected to infection of the caryopsis by dusting with chlamydospores. It is concluded that the relative tightness of the hulls enveloping the caryopsis is responsible for the variation in the incidence of smut on plants from different seed lots.

The sample of Anthony oats yielding the fewest diseased plants germinated more rapidly and produced larger seedlings than the other lots of the same variety, suggesting that more vigorous plants are less liable to infection than weaker ones.

On the basis of these observations the author recommends the use of seed from one harvest for a successive period, e.g., of five years, for the purpose of physiologic race determination, such a procedure being more likely to ensure uniform results than annual trials of new lots.

ROY (W. R.). **Studies of boron deficiency in Grapefruit.**—*Citrus Ind.*, xxiv, 8, pp. 4–5; 9, pp. 5, 8, 1943. [Abs. in *Chem. Abstr.*, xxxvii, 21, pp. 6306–6307, 1943.]

Boron deficiency symptoms induced in grapefruit trees growing in sand cultures included curling of the leaves, corking of the veins, extensive defoliation, excessive dropping of the fruits, the development of boron stains in the albedo, malformation, and the production of a drop of crystal gum on the receptacle remaining on the

trees after the shedding of the fruits. Rough lemon should be a more suitable root stock than sour orange for grapefruit trees where boron deficiency is to be feared, owing to the larger intake of the element by the former.

KLOTZ (L. J.). **Brown rot and gummosis infections causing serious losses.**—*Calif. Citrogr.*, xxix, 5, p. 116, 4 figs., 1944.

Brown rot and gummosis [*Phytophthora* spp.: *R.A.M.*, xxii, p. 354] are stated to have been causing unusually severe losses (particularly to lemon, Navel orange, and Valencia orange trees) in Californian orchards since 1938, owing largely to wet winters, lack of spray protection of fruit and of tree care. Growers are urged to apply sprays. The new compound tetrachloro-para-benzoquinone, when used at the rate of 1 lb. per 100 gals. gave satisfactory protection both in the grove and in the laboratory on detached fruits, but when used at the rate of ¼ or ½ lb., was effective only in the laboratory, failing to protect fruits in the grove following 6 in. of rain and strong winds.

In the packing house, where the importance of the hot water treatment is again emphasized, the fruit, particularly lemons, when cold and turgid, should be permitted a period of slight wilting before immersion, as this obviates the danger of the liberation of rind oil which causes spotting. Although hot water treatment was experimentally shown to stop the progress of decay after the brown rot spots become visible to the unaided eye, in commercial practice fruit with such spots should be eliminated.

The excessive rainfall and flood conditions in southern California during the past several seasons are stated to have favoured the development of many cases of gummosis. It has been estimated that in Orange county alone 300,000 trees were found infected following the flood of 1938. Throughout the citrus belt old trees that have escaped infection for over half a century were found to be so badly diseased that tree surgery could no longer save them. Even the bud unions on the gummosis-resistant sour orange trees, where permitted to stand in contact or to be splashed with water swarming with the zoospores of the fungi, became infected. The standard surgical method recommended for the treatment of gummosis infections consists in the removal of the diseased bark and a ¼- to ½-in. strip of healthy bark beyond the margin of the dark brown diseased area discernible on the inner surface of the bark or the surface of the wood, using a heavy, sharp knife for the smooth parts of the trunk and a scaly-bark scraper for the irregular bud union and crown and root areas. The exposed area is then dusted with spray-dried Bordeaux or zinc-copper-lime, or tetrachloro-para-benzo-quinone, or is painted with 1 per cent. permanganate of potash solution, or with a suspension of any of the above three dusts. The treated lesion is allowed to dry for a week or more, depending on the weather, and then painted with tree seal or white lead paint.

BLACKFORD (F. W.). **Citrus fruit rots and blemishes.**—*Qd agric. J.*, lviii, 1, pp. 33–38, 2 figs., 1944.

Continuing his earlier paper [*R.A.M.*, xxiii, p. 175], the author gives brief, popular notes on the symptoms and control of the following diseases of citrus in Queensland: blue mould [*Penicillium italicum*], green mould [*P. digitatum*], brown rot [*Phytophthora citrophthora* and *P. parasitica*: ibid., xxii, p. 132], stem-end rot [*Phomopsis* [*Diaporthe*] *citri* or *Diplodia natalensis*: ibid., xx, p. 13], sooty mould, smoky blotch, or fly speck [*Leptothyrium* sp.: ibid., xvii, p. 587], oleocellosis [ibid., xix, p. 86], rind breakdown due to rain, dew, or excessive humidity [ibid., xx, p. 151], and stylar-end rot of limes produced by hot, dry weather.

Measures for the control of rind breakdown have not yet been finally drawn up, but it is suggested that the fruit should be picked as soon as possible after it has

matured, and that, if the trouble has already appeared, affected fruit should be carefully culled during packing, in order to avoid loss in transit. It is worth while to hold the fruit a little longer than usual in the packing shed, so that fruit with a tendency to rot may be discarded.

The incidence of stylar-end rot may be reduced by keeping the soil moist, applying smaller amounts of fertilizers rich in nitrogen, and picking the fruit early.

Sandoz (Mildred D.), Rogers (Rosalie), & Newcombe (C. L.). **Fungus infection of eggs of the Blue Crab, Callinectes sapidus Rathbun.**—*Science*, N.S., xcix, 2563, pp. 124–125, 1944.

Blue crab (*Callinectes sapidus*) eggs infected by fungi identified by J. H. Couch as *Lagenidium callinectes* [*R.A.M.*, xxii, p. 136] and *Rhizophidium* sp. in Tidewater, Virginia, are usually under-sized, and gave rise in laboratory tests to abnormal prezoeae, which rarely survived longer than 48 hours. Infected egg masses suspended in the York River in 1942 failed to hatch, and substantial fungal growth was made. Infection may occur at all stages in the development of the eggs, its incidence varying markedly in different parts of the area under observation. The parasitic fungi represent an important contributory factor in the reduction of the population of *C. sapidus*, and attention should be paid to their distribution in any site likely to be selected as a reservation for the protection of brood stock.

Magee (C. J.). **Orchid mosaic.**—*Aust. Orchid Rev.*, viii, 4, pp. 51–52, 2 figs. (1 on p. 53), 1943.

Cymbidium orchids in New South Wales are liable to a form of mosaic known to members of the Orchid Society as 'black disease'. The first symptom of infection is a yellow flecking or streaking of the youngest leaves, followed by the development of black spots and streaks on both the upper and lower surfaces. Growth is retarded and the plants become more or less enfeebled according to the variety affected. A species of *Dendrobium* has also been observed to bear the mosaic lesions, the agent of which is probably the tomato spotted wilt virus, though its exact identity requires further study. Precautionary measures pending a fuller knowledge of the disease should include the rejection of all suspected plants for propagation, the removal of weeds and diseased ornamentals from the vicinity of the collections, and the isolation of infected orchids.

Sprague (R.). **Phoma terrestris on Gramineae in the northern Great Plains.**—*Phytopathology*, xxxiv, 1, pp. 129–131, 1944.

During the three-year period from 1940 to 1942, *Phoma terrestris* represented only 2·3 per cent. of the 16,086 pure cultures of all species of fungi isolated from the roots of field-grown plants in North Dakota, but it numbered among its hosts 55 members of the Gramineae [*R.A.M.*, xxi, p. 118], including oats, barley, sorghum, Sudan grass, wheat, maize [ibid., xxii, p. 429], *Agropyron* spp. (seven), *Andropogon furcatus* and *A. hallii*, *Bromus inermis*, *Dactylis glomerata*, *Echinochloa crus-galli*, six species of *Elymus*, *Festuca rubra*, *Panicum miliaceum*, *Phleum pratense*, *Poa pratensis*, *Setaria italica*, and *S. viridis*, besides *Allium cernuum*, vegetable marrow, flax, and *Lepidium campestre*. The results of greenhouse inoculation experiments showed the fungus to be, at the most, very weakly parasitic, and probably only pathogenic to plants making slow growth in cool (50° F.), wet soil. The pink-root condition in maturing cereals represents a saprophytic phase of *Phoma terrestris* on small roots killed by other fungi, notably the destructive *Pythium arrhenomanes*, or by drought.

Some cultures of the pink-root fungus from grasses and wheat produced elliptical, hyaline pycnospores, 3 to 4·8 by 1 to 1·5 μ, on *Melilotus* culms or maize meal in flasks, but even the sterile cultures, with their mounded, velvety, grey, rose-,

plum-, or vinaceous-tinted colonies, are readily distinguishable from those of other Graminaceous fungi. Considerable variation is noticeable in the fungus and several distinct strains are distinguishable.

Fruit tree spraying in Kent.—*J. Minist. Agric.*, li, 1, pp. 43–44, 1944.

A special Spraying Advisory Committee, established by the Kent War Agricultural Executive Committee, has evolved a scheme by which fruit-tree spraying machines supplied to the Committee are hired out to contractors, each of whom is given a certain area to work. The contractor sprays any orchard in his area at the request of the Committee's local Fruit Surveyor, and may also spray any other orchards belonging to farmers who lack equipment. The scale of charges laid down by the Committee has been accepted by all the contractors. A simple spray schedule has also been recommended. The machines have tanks of 250 gals. capacity and can deliver up to 15 gals. of spray per minute. As they travel between the rows one operator sprays the trees on one side and a second those on the other. Over 50 of these machines are already at work in Kent.

MOORE (M. H.). **Control of Apple scab.**—*Fruitgrower*, xcvii, 2523, pp. 295–296, 1944.

On the basis of experience at the East Malling Research Station, the author makes two practical suggestions for the assistance of fruit-growers in controlling apple scab [*Venturia inaequalis*]. In the first place, not more than a fortnight's interval should separate consecutive treatments at the green-cluster, pink-bud, and petal-fall stages. If pink-bud rapidly follows green-cluster on account of weather conditions, the appropriate treatment should not be omitted, but the most susceptible varieties at any rate should be sprayed with lime-sulphur alone at a strength of 1 or 1·5 per cent. Following the 2·5 per cent. with or without lead arsenate at green-cluster, the weaker spray will be quite innocuous, and will freshen up the deposit for the blossom period. Another important point is to have all the apparatus in readiness to start the petal-fall application not more than a fortnight after pink-bud, even if there is still a fair sprinkling of bloom on the trees. In fact, trees in full bloom have been sprayed with 1 per cent. lime-sulphur or 6 lb. colloidal sulphur per 100 gals. without interrupting the activity of bees for more than an hour or so [*R.A.M.*, xxii, p. 315], and a full crop was subsequently picked. Once scab gains a foothold among the minute fruitlets, dropping ensues and the crop will be greatly reduced. Lead arsenate should not be added to the 1 per cent. lime-sulphur spray at petal-fall owing to the risk of arsenical injury and the danger to bees working late blooms [loc. cit.], but nicotine may be applied at this stage against sawfly [*Hoplocampa testudinea*]. Copper-lime dusts have been helpful to many growers in tiding over a long blossom period. It is most inadvisable to postpone scab control treatment even for a few days in the critical months of April and May.

PERLBERGER (J.). **The rust disease of stone fruit trees in Palestine.** PERLBERGER (J.) & PALTI (J.). **Spraying trials for the control of the rust disease of stone fruits.**—*Bull. Rehovoth agric. Exp. Sta.* 34, 17 pp., 8 figs., 1943. [Hebrew, with English summary.]

Puccinia pruni-spinosae is found in Palestine on the leaves of almonds, plums, apricots, peaches, and nectarines, on which it produces yellow, angular lesions, though on peach leaves they may be round. It sometimes has a complete life-cycle; uredospores and teleutospores were found on stone fruits, and aecidia on *Anemone*. It may be assumed that infection is spread chiefly by uredospores, completion of the life-cycle being of minor importance. Locally, the disease may develop in all parts of the country during winter, but in summer only areas with a relatively low temperature and high atmospheric humidity are affected. This

means that in summer the rust is found in the coastal region and the mountainous parts, but not in the Jordan Valley or the eastern section of the Esdraelon Valley. On stone fruit trees infection spreads for the most part after harvest, from July onwards, through autumn and winter, and causes premature defoliation. Occurrence in spring is rare. Under the local conditions, the fruits are not affected. The development of the rust is further restricted by *Darluca filum*, which is often found on the sori.

In two years' spraying trials, the lime-sulphur spray sulfinette (33° Bé) [see above, p. 253] at a concentration of 1 in 60 controlled *P. pruni-spinosae* on seedlings of bitter almond, myrobolan plum [*Prunus divaricata*], and apricot, and on Kelsey, Santa Rosa, and Wickson plum trees, while it also prevented premature defoliation. In one year's trial, spraying with cita lime-sulphur spray (33° Bé) [loc. cit.] at 1 in 60 controlled the disease on bitter almond seedlings and prevented premature defoliation. Under Palestine conditions, spraying should be effected in summer and early autumn at intervals of 10 to 18 days.

KUNKEL (L. O.). **Viruses in relation to the growth of plants.**—*Torreya*, xliii, 2, pp. 87–95, 9 figs., 1943.

In this paper, read at the 75th anniversary celebration of the Torrey Botanical Club in June, 1942, the author reports as new hosts of the cranberry false blossom virus tomato, *Vinca rosea*, *Calendula*, and *Nicotiana glutinosa*.

In all hosts the false blossom virus depresses growth in the plant as a whole, but stimulates the rate of growth in the flowers. In a number of plants to which it was taken it caused the production of giant blossoms. In tomato, the sepals of the diseased flowers were much larger than the sepals of normal flowers and instead of remaining separate fused into a sac-shaped structure, within which the petals were found to be green and borne at the end of a thick stalk about 1 in. long. In structure, the petals resembled leaves; some were simple, others compound. The anthers were generally small and green. In its effect on tomato flowers, the disease resembles big bud [*R.A.M.*, xxii, p. 457].

Apparently, several different strains of the false-blossom virus exist. From some diseased cranberries a strain was obtained that severely checked longitudinal, though it stimulated transverse, growth. Plants with this strain stopped producing flower buds soon after infection, and the growth of secondary shoots was not stimulated. From other cranberries a strain was obtained which stimulated longitudinal and checked transverse growth. This gave a spindling witches' broom type of growth. In tomatoes with the spindling strain no flower buds were produced except soon after infection. The flowers were not more than two or three times normal size. Other strains caused intermediate effects between the two extremes. The virus from most diseased cranberries caused the big-bud type of top in tomatoes, with large, malformed flowers and numerous secondary shoots. When the two extreme types were transmitted to periwinkle [*Vinca rosea*: ibid., xxi, p. 340] they caused similar variations in symptoms. When the common type of false-blossom virus was transmitted to *Calendula*, it caused the production of malformed green flowers. It also caused gigantism in *N. glutinosa*. In all the plants to which the false-blossom virus was taken it caused virescence and gigantism in flower or parts of flowers, chlorosis and dwarfing of leaves, and elongation or shortening of the internodes of the stems.

STEVENS (N. E.). **Cranberry false blossom in relation to flooding water.**—*Phytopathology*, xxxiv, 1, pp. 140–142, 1944.

Evidence in the form of field observations in Wisconsin over the past seven years is adduced in support of the opinion that freedom from false blossom in cranberries

[see preceding abstract] is correlated with the presence of alkaline flooding water (P_H 7·4 and upwards).

Dimond (A. E.) & Horsfall (J. G.). **Synergism as a tool in the conservation of fungicides.**—*Phytopathology*, xxxiv, 1, pp. 136–139, 1944.

Some illustrations are given of the principle of synergism between different fungicides in connexion with the campaign for economy in the utilization of copper, the estimated consumption of which (as copper sulphate) in the United States during 1942 was 100,000,000 lb. For instance, in the synergistic system consisting of cuprous oxide and elemental sulphur, of which the former is toxic and the latter non-toxic to *Macrosporium* [*Stemphylium*] *sarciniforme*, the admixture of 30 per cent. of the latter with 70 per cent. of the former effects the maximum saving of copper, the total quantity of fungicide and dosage of cupric oxide required for 50 per cent. inhibition of spore germination being only 2·12 and 1·48 γ per sq. cm. compared with 5 and 5, 3·41 and 3·31, and 2·50 and 2·25 γ for the 100 : 0, 97 : 3, and 90 : 10 ratios of cuprous oxide to sulphur, respectively. In addition to laboratory tests, a field experiment was carried out to determine the value of cuprous oxide and sulphur mixtures in the control of tipburn, the results of which showed the optimum proportions for this purpose to be 75 : 25 and 90 : 10 per cent. The same combination was less effective against *Sclerotinia fructicola* and failed to protect celery from infection by *Septoria apii*.

In laboratory trials with mixtures of carbon disulphide and dimethyl amine, using *Sclerotinia fructicola* as the test fungus, the best results were secured with ratios of 50 : 50, 63·2 : 36·8, and 72·9 : 27·1, at which the relative dosage required for 50 per cent. inhibition of spore germination was 1·01, 1·00, and 1·06, respectively, compared with 660·00 at 100 : 0·0 and 61·50 at 0·0 : 100·0, respectively.

Other promising two-member systems include cuprous oxide with metallic oxides, e.g., zinc or lead, and either metallic oxides, mercaptobenzothiazole, or diphenyl amine with sulphur.

Glick (D. P.). **The deterioration of disinfectants in agricultural use.**—Abs. in *J. Bact.*, xlv, 1, pp. 42–43, 1943.

At the Colorado Agricultural Experiment Station, solutions of 0·2 per cent. mercuric chloride, 1 per cent. iodine, 2,000 p.p.m. chlorine, 2 per cent. cresol, and 5 per cent. phenol, which had been used for the continuous sterilization of rotary seed potato cutting knives to prevent the spread of *Phytomonas sepedonica* [*Corynebacterium sepedonicum*], were tested for their pathogenicity to *Escherichia* [*Bacterium*] *coli* in broth cultures. The organism withstood exposure to 1-gal. lots of the disinfectants after the cutting of 10, 8, 8, 24, and 12 100 lb.-sacks of potatoes, respectively. Moreover, field tests for the transmission of *C. sepedonicum* proved that the mercuric chloride, chlorine, and cresol solutions became ineffective after cutting 6, 6, and 18 sacks, respectively. The substitution of boiling water for the chemicals gave satisfactory results.

When a solution containing 180 p.p.m. available chlorine was used in a 2,000-gal. wash tank to control the spread of *Colletotrichum lagenarium* among honeydew melons before shipment, the chlorine content fell to 90 p.p.m. after the immersion of 35 tons in one day. A chlorine content of 400 p.p.m. fell to 200 following the washing of 70 tons of melons in one day.

Cox (A. J.). **Terminology of insecticides, fungicides and other economic poisons.**—*J. econ. Ent.*, xxxvi, 6, pp. 813–821, 1943.

The importance of the clear, precise, and adequate expression of technical language is emphasized and the use of misleading or ambiguous phraseology deprecated. The correct designation of insecticides, fungicides, and the like is not

only essential for the attainment of maximum results by manufacturers and users, but also of assistance to entomologists, plant pathologists, and chemists interested in advancing the knowledge of their work.

TERHORST (W. P.) & FELIX (E. L.). **2, 3-dichloro-1, 4-naphthoquinone; a potent organic fungicide.**—*Industr. Engng Chem.*, xxxv, 12, pp. 1255–1259, 5 figs., 1943.

The annual fungal damage to United States agriculture has been computed at \$1,000,000,000, the yearly loss from raw cotton mildew alone being calculated at \$25,000,000 to \$75,000,000 (*Oil Paint Drug Rep.*, p. 41, 1st July, 1940). Among the many quinone-type chemicals that have been tested in the search for a potent and safe fungicide for use both in agriculture and the textile industry, 2, 3-dichloro-1, 4-naphthoquinone is outstanding, its efficiency in the control of 22 important fungi of widely divergent groups having been established. The compound is 4 per cent. soluble in xylene and ortho-dichlorobenzene, fairly soluble in dioxane, acetone, benzene, and diethyl ether, and slightly soluble in glacial acetic acid, ethyl alcohol, carbon tetrachloride, Skellysolve B, cellosolve, Stoddart solvent, gasoline [petrol], cod, cottonseed, and castor oils, and nujol; its solubility in water at P_H 7 is of the order of 1 to 10,000,000. The vapour concentration of 2, 3-dichloro-1, 4-naphthoquinone at 100° C. is 0·2 mg. per l.

In greenhouse tests at the General Laboratories, U.S. Rubber Company, Passaic, New Jersey, the maximum control (90 to 94 per cent. plant stand) of *Pythium ultimum* on peas under optimum conditions for disease development was secured by a dosage of the fungicide of 0·56 to 1·12 oz. per bush. seed, while for practical purposes a concentration of 0·28 oz., equivalent to $\frac{1}{32}$ per cent. by seed weight, sufficed. The average pea stand at the latter concentration in 12 experiments was 80 per cent., compared with 24 per cent. in the control plots, the corresponding mean heights of the plants at ten days being 5·97 and 4·67 cm., respectively, a highly significant difference. Excess dosages of 4·48 and 8·96 oz. per bush. did not injure the seed. The toxicity of 2, 3-dichloro-1, 4-naphthoquinone to *Ustilago* sp. in slide tests indicates a potential use against cereal smuts. Under the same conditions the compound completely prevents the germination of cotton anthracnose (*Glomerella gossypii*) spores at or below 1 p.p.m., while test-tube cultures of treated and untreated cotton seed heavily infested by the pathogen showed a dosage of 6 oz. at a strength of 12·5 per cent. (0·75 oz. per bush.) to be completely toxic to the fungus when applied three months before planting. In greenhouse trials, 2, 3-dichloro-1, 4-naphthoquinone, applied just before planting, at the rate of 0·5 oz. active material per bush., appreciably reduced the incidence of *Rhizoctonia* [*Corticium solani*] and *G. gossypii*: at this concentration the stand from seeds infected by the former pathogen amounted to 60 per cent. compared with 0 for the untreated, the corresponding figures for the latter being 83 and 63, respectively.

Various articles of equipment of the armed forces require protection against mildew [*R.A.M.*, xxiii, p. 71], and 2, 3-dichloro-1, 4-naphthoquinone has proved highly effective for this purpose in laboratory and soil burial tests. In some of the latter, *Stachybotrys* spp. (probably *S. atra*, *S. papyrogena*, and *S. cylindrospora*) were destructive to cotton fabrics. Using the procedure of McCallan and collaborators, subsequently adopted by the Committee on Standardization of Fungicidal Tests, American Phytopathological Society [ibid., xxii, p. 489], the toxicity of the compound to *Metarrhizium* sp. and *S.* sp. was determined and the LD50 and LD95 values for the two organisms determined as 0·37 and 0·56 and 1·3 and 2·5 p.p.m., respectively. In fabric inoculation tests with *Chaetomium globosum*, 2, 3-dichloro-1, 4-naphthoquinone entirely prevented the development of the mould on impregnated duck. The quinone, which exerts no adverse effects on the strength of the treated fabrics, may be applied in any of four ways, viz., in an organic solvent (0·1 per cent.

for light cotton sheeting, 0·5 to 1 per cent. for heavier materials); in aqueous suspensions of P_H 4 to 5, containing 20 per cent. active chemical and the necessary protective agents; in a lacquer (for wood, rubber, and the like); or by one hour's exposure to vapour at 125° C.

MARSH (P. B.), GREATHOUSE (G. A.), ROLLENBACHER (KATHARINA), & BUTLER (MARY L.). **Copper soaps as rot-proofing agents on fabrics.**—*Industr. Engng Chem.*, xxxvi, 2, pp. 176–181, 2 figs., 1944.

Of the four copper-containing soaps, viz., copper naphthenate (8 per cent. copper), copper oleate (10 per cent.), copper tallate (7 per cent.), and copper hydrogenated resinate (6 per cent.) tested for the prevention of fungal rotting of cotton duck fabrics [see preceding abstract], the first-named alone suppressed the growth of the copper-tolerant *Aspergillus niger*, which was inhibited on the glucose- and peptone-containing three-salt medium of Greathouse *et al.* [*R.A.M.*, xxii, p. 73] in the presence of 0·2, 0·4, or 0·8 per cent. of copper naphthenate, while continuing to develop at these levels in that of the other compounds. The high preservative value of copper naphthenate is attributed to the fact that its organic acid radical, naphthenic acid, effectively inhibits the growth of *A. niger*, *Penicillium* sp., *Chaetomium globosum*, and *Metarrhizium* sp., and protects the fabric against deterioration in the soil. No such action was exerted by tall oil, oleic acid, or hydrogenated resin. Copper naphthenate drastically leached with dilute nitric acid until essentially free of copper retained sufficient residual potency to prevent the growth of *A. niger* and to protect the fabric from deterioration in the soil.

Fabrics impregnated with copper oleate, copper naphthenate, and copper tallate lose copper readily at the points of contact between the material and the soil. Each of these compounds is insoluble in water, but may be rendered soluble by acid hydrolysis or by reaction with materials forming soluble copper complexes. Thus, a neutralized sodium hydroxide extract of soils will bring copper soaps into solution, while neutralized solutions of a variety of naturally occurring hydroxy and amino acids, e.g., gallic, aspartic, glutamic, and gluconic, act in a similar manner. Copper hydrogenated resinate, on the other hand, is highly resistant to leaching under comparable conditions, its relatively poor protective power in contact with soils being perhaps partly due to the low availability of ionic copper.

The relative superiority of copper naphthenate to the other three copper soaps under investigation was accentuated in comparative tests by soil factors tending to minimize the preservative value of the copper, i.e., leaching, adsorption, and chemical deactivation.

GERSHENFELD (L.). **Ultraviolet light as a sanitary aid.**—*Rep. Smithson Instn, 1942*, pp. 209–225, 1943.

After referring to the susceptibility of micro-organisms to ultra-violet radiation, the author discusses the production of such radiation by means of lamps and the use of ultra-violet light as a practical sanitary aid. An important section of the paper is devoted to this form of sanitation as applied to the meat, baking, and dairy industries and to various foods and beverages [*R.A.M.*, xix, p. 159]. Ultra-violet light properly used on meat in large walk-in refrigerators, refrigerated freight cars, small coolers, and refrigerated display cabinets gives an all-round better and more sanitary product than is possible without it. By reducing mould and bacterial growths, it saves trimming the meat, and washing and cleaning its surfaces. The Tenderay process, developed at the Mellon Institute, utilizes ultra-violet light for inhibiting mould and bacterial growth as an essential part of its operation.

Many large bakeries use ultra-violet radiation throughout the entire processing, especially from the moment the products leave the oven until they are 'packaged'. Conveying, cooling, slicing, and wrapping are carried out under irradiation, which

frees even the wrapping material from contamination by yeasts, moulds, and bacteria. Not only are the air and the equipment continuously irradiated, but the destruction of yeasts and moulds on nuts, raisins, and other ingredients is also effected by radiation. Treatment has greatly improved the keeping qualities of these products, even after they reach the consumer.

The process is being increasingly used in dairying, in poultry houses and incubator rooms, and in preserve-making and the preparation of bottled drinks.

PITMAN (G. A.). **Mold count recording device.**—*J. Ass. off. agric. Chem., Wash.*, xxvi, 4, pp. 511–513, 2 figs., 1943.

The official method for the determination of mould in tomato products specifies examination with a microscope at about 100 diameters magnification of 25 fields on each of two or more Howard slides, the fields being spotted within a 19 mm. circle. Heretofore, the data have been recorded by any system approved by the analyst or group concerned, but all such methods have necessitated shifting the eyes from the microscope to permit manual notation of the presence or absence of mould hyphae, and the consequent repeated refocusing and reaccommodation involves a great strain on the sight. To obviate this source of fatigue, a contrivance has been devised, and is here fully described, whereby a piece of paper fastened to the mechanical stage and moving with the slide can be marked automatically as each positive field is encountered. A legible record is thus provided of the number and relative positions of the contaminated fields without removing the eyes from the microscope.

McKEE (CLARA M.), RAKE (G.), & HOUCK (CAROL L.). **Studies on Aspergillus flavus. II. The production and properties of a penicillin-like substance—flavacidin.**—*J. Bact.*, xlvii, 2, pp. 187–197, 1 graph, 1944.

Under certain conditions, notably in the form of submerged growth in a modified Czapek-Dox medium with agitation and aeration, the mould *Aspergillus flavus* produces a substance designated flavacidin, which resembles penicillin in the following characteristics: (*a*) both are highly active against Gram-positive organisms and relatively non-toxic to those of the Gram-negative group; (*b*) both protect mice in an equal degree against *Pneumococcus* infection; (*c*) both are highly soluble and hence readily absorbed after parenteral inoculation and rapidly excreted by the kidneys; (*d*) cultures resistant to the action of penicillin react similarly to flavacidin but not to other antibiotic substances; and (*e*) an enzyme active against penicillin affects flavacidin, but not other antibiotic substances, in a similar manner.

WAKSMAN (S. A.). **Purification and antibacterial activity of fumigacin and clavacin.**—*Science*, N.S., xcix, 2568, pp. 220–221, 1944.

This is a brief summary of the results thus far obtained in the study of the antibacterial substances fumigacin and clavacin [*R.A.M.*, xxii, p. 267; xxiii, p. 156]. It is considered that helvolic acid, recently isolated from a strain of *Aspergillus fumigatus* by E. Chain *et al.* (*Brit. J. exp. Path.*, 24, pp. 108–119, 1943) [and next abstract] is identical with fumigacin; and that patulin, claviformin, clavatin, crystalline clavacin, and crude clavacin are all identical in their chemical nature and antibacterial activity. It appears to be thus established that *A. clavatus*, *Penicillium claviforme*, and *P. patulum* produce the same antibiotic substance. Many organisms are capable of producing more than one type of substance and *A. fumigatus* forms four: spinulosin, fumigatin, fumigacin, and gliotoxin, the first two of which are closely related.

MENZEL (A. E. O.), WINTERSTEINER (O.), & HOOGERHEIDE (J. C.). **The isolation of gliotoxin and fumigacin from culture filtrates of Aspergillus fumigatus.**—*J. biol. Chem.*, clii, 2, pp. 419–429, 1944.

Aspergillus fumigatus, grown on the Czapek-Dox medium, produces simultaneously two antibiotic agents, gliotoxin and fumigacin, of which the former accounts for the greater part of the antibiotic activity. In studies at the Squibb Institute for Medical Research, New Brunswick, on the production of the two compounds under various conditions, it was demonstrated that the crystalline material previously described as fumigacin [*R.A.M.*, xxii, p. 267] is a mixture of that substance and gliotoxin [ibid., xxi, p. 216]. In respect of its chemical and bacteriological properties, pure fumigacin appears to be identical with the helvolic acid recently isolated by Chain *et al.* from the same source [see preceding abstract].

BLACKWELL (ELIZABETH). **Species of Phytophthora as water moulds.**—*Nature, Lond.*, cliii, 3886, p. 496, 1 fig., 1944.

The author states that parasitic species of *Phytophthora* may masquerade as saprophytic water moulds for long periods of time until they are carried by water to fields where they may attack crops. She asks for the collaboration of mycologists in determining the distribution of *Phytophthora* in British streams, ponds, and ditches and gives directions with regard to the method of collection, type of bait and container, and treatment, identification, and transport of the collected material.

RYAN (F. J.), BEADLE (G. W.), & TATUM (E. L.). **The tube method of measuring the growth rate of Neurospora.**—*Amer. J. Bot.*, xxx, 10, pp. 784–799, 1 fig., 6 graphs, 1943.

The authors describe the following technique for studying the growth of *Neurospora* spp. (mainly *N. crassa* and *N. sitophila*) in culture; the method is also considered suitable for bio-assay work. Horizontally fixed glass tubes (40 cm. long with an internal bore of about 13 mm.), both the open ends of which are bent up at an angle of 45°, are half-filled with a standard solid medium, the openings then stoppered with cotton, and tubes and media autoclaved for 10 to 15 mins. at 15 lb. pressure. On cooling, the media are inoculated by introducing conidia or mycelia into the tubes at one end only, and the position of the advancing mycelial frontier is measured at convenient time intervals by marking the tube. Later these measurements are plotted against time, and the rates of growth determined from the linear positions of the curves. The standard deviation of the rate of growth in the tube method is 3·6 per cent. of the mean. It was found that factors influencing the rate of growth of *Neurospora*, and which should be held constant, are composition and concentration of salts in the medium, carbon and nitrogen sources, trace elements, purity and concentration of agar, hydrogen-ion concentration, temperature, and the depth of the medium in the tubes; on the other hand, factors having little or no effect are tube size, gas diffusion, light, humidity, nature of inoculum, and presence of vitamins or amino acids. Standard conditions selected on the basis of these findings are described.

MARCHIONATTO (J. B.). **La obra fitopatológica de L. Hauman en la Argentina.** [The phytopathological work of L. Hauman in Argentina.]—*Rev. Fac. Agron., B. Aires*, x, 3, pp. 363–369, 1943 (issued 1944). [English and Portuguese summaries.]

This is a commentary on the phytopathological studies carried out by L. Hauman during his tenure of the Chair of Botany at the College of Agriculture, Buenos Aires, from 1904 to 1925, among those referred to being the revised list (prepared

in collaboration with L. Parodi) of vegetable parasites of cultivated plants in Argentina [*R.A.M.*, i, p. 182].

PADWICK (G. W.). **Some problems of control of soil-borne fungal diseases in plants.** —*Anniv. Vol. R. bot. Gdn, Calcutta, 1942*, pp. 213–220, 1942.

Following a review of some important contributions to the knowledge of antagonism between fungi in relation to the control of soil-borne plant diseases, the writer discusses illustrations from his experience of the complexity of the root-invading microflora.

The first example concerns *Ophiobolus graminis*, typical lesions of which on wheat roots yielded numerous cultures of *Fusarium avenaceum*. In an experiment to determine the possibility of joint invasion by the two organisms, wheat was sown in sterilized soil in pots; in the same heavily inoculated with *O. graminis*; in the same after immersion of the seed in a spore suspension of *F. avenaceum*; and in a fourth series, sterilized soil was inoculated with *O. graminis* and planted with seed infected by *F. avenaceum*. In the first lot, the seedlings were healthy; in the second, the entire root system was rotted, the stems blackened to an inch or so above soil-level, and the plants severely stunted; in the third, the seedlings were slightly stunted and the stems and roots bore well-defined, reddish-brown lesions; and in the fourth, the plants, though significantly more dwarfed than those attacked by *O. graminis* alone, showed the external symptoms of the latter fungus only. Isolations from the surface-sterilized stem tissues of plants inoculated with *O. graminis* alone yielded only *O. graminis*, and those with *F. avenaceum* alone only *F. avenaceum*: on the other hand, the plants jointly inoculated with the two fungi and manifesting only the features of *O. graminis* uniformly gave rise to *F. avenaceum*, with no trace of the agent of the major disease.

In the second case, the author and N. Prasad isolated from gram (*Cicer arietinum*) stems an extremely varied collection of *F.* spp., some of which were experimentally proved to be capable of causing seed decay, while others were responsible for wilting. The publication of this work is expected shortly.

In the third instance, isolations were made from the stipules, stems, leaves, and roots of 'foot-rotted' *Piper betle* plants from six gardens in the State of Chhatarpur, 25 of *F.* and 10 of *Colletotrichum* being obtained from 40 pieces of stipule tissue, while the corresponding numbers for 30 pieces of stem, 10 of leaf, and 30 of root tissue were 7 and 19, 1 and 4, and 17 and 1, respectively; the leaves further yielded two unidentified fungi and the roots one. Neither *Phytophthora* nor *Rhizoctonia* was isolated, though the former was observed in some of the leaf sections. These observations suggest that a fungal complex may be implicated in the etiology of the disease.

Various general deductions are drawn from these and other similar cases.

BERKELEY (G. H.). **Root-rots of certain non-cereal crops.**—*Bot. Rev.*, x, 2, pp. 67–123, 1944.

After a brief introduction, the author reviews the literature on the root rots of woody perennials, tobacco, cotton, sugar beet, peas, vetches, clovers, sugar-cane, maize, pineapple, flax, soy-bean, broad bean, ginseng, strawberries, raspberries, vegetables, and herbaceous ornamentals, and then discusses the relation of temperature, soil reaction, and humidity to that group of diseases, and their control by means of resistant varieties, crop rotation, biological agents, fertilization, soil disinfection, organic manures, ringing, felling, and barriers. Concluding sections are devoted to types of root rot and trends in research. A bibliography of 347 titles is appended.

Agricultural education in Victoria. Report of the Victorian Branch.—*J. Aust. Inst. agric. Sci.*, ix, 4, pp. 141–153, 1943.

In this report on post-war agricultural education by the Victorian branch of the Australian Institute of Agricultural Science, the organization of the State extension service and agricultural training are discussed in some detail. *Inter alia*, it recommends that a Division of Publicity should be established, with a staff that includes graduates in agricultural science with experience in journalism.

Curtis (L. C.). **Deleterious effects of guttated fluids on foliage.**—*Amer. J. Bot.*, xxx, 10, pp. 778–781, 4 figs., 1943.

Observations in the field and greenhouse showed that three things may happen to the guttation drop on a plant: (1) it may roll off, (2) it may evaporate, or (3), as most frequently happens on undisturbed plants, it may be sucked back into the leaf. When neutral red crystals were placed in the guttation drop of maize and squash (*Cucurbita maxima*) plants, the drop was sucked back into the leaf and the vascular system of such a leaf was stained for a distance of one to three inches.

On the basis of these observations, an hypothesis is advanced to explain some of the common types of tip burn found in many economic and ornamental plants. When the guttation water evaporates on the tips of the leaves, there remain various salt deposits which may increase due to a continuous guttation process over a one-, two-, or even three-day period. These deposits may affect the leaf in two ways. Because of their high salt concentration they may remain and damage the outside of the leaf in the same way that fertilizer does when it is put on leaf blades, or they may dissolve in subsequent guttation water and be sucked back into the leaf, where the hypertonic solution kills the cells. Changes in the guttation fluid, which are toxic to the internal cells, may be produced by bacteria, moulds, or enzymes. The hypothesis also explains how non-motile bacteria and chemical substances applied to the leaf as fungicides may enter the leaf.

Björkman (E.). **The effect of strangulation on the formation of mycorrhiza in Pine.**—*Svensk bot. Tidskr.*, xxxviii, 1, pp. 1–14, 9 figs., 1 graph, 1944.

In three-year-old potted pine plants constricted on 5th May, 1943, by means of thin iron wire 5 cm. above ground-level, mycorrhizal formation was almost completely inhibited during the subsequent growing period. After the performance of the operation, the amount of soluble carbohydrates in the roots dwindled to insignificant proportions in comparison with that in the controls because of the interruption in the supply to the roots of the products of photosynthesis. The author's hypothesis that mycorrhizal formation is largely conditioned by an excess of soluble carbohydrates in the roots (*Symb. bot. upsaliens.*, vi, 2, 1942) was thus confirmed. The mycorrhizal fungi did not assume a strictly parasitic mode of existence when the root system of the pines became debilitated through the constriction of the stems. On the contrary, they ceased to attack the roots lacking in carbohydrates, just as in the case of plants receiving insufficient light, whereas the unconstricted controls, with their well-developed root systems, were enveloped in copious mycorrhizal mantles. Mycorrhiza, therefore, may be regarded as parasites on their hosts in respect of energy, but not as parasites in the usual sense of the word; they do not injure the host. The facts recorded in this paper correspond very well with the inability of mycorrhizal fungi to utilize such sources of carbon as cellulose, starch, and even saccharose. According to Melin [*R.A.M.*, v, p. 245] and Norkrans (*Svensk. bot. Tidskr.*, xxxviii, 1944), mycorrhizal fungi are unable to utilize any carbon sources other than readily soluble carbohydrates, especially glucose. Nothing in the outcome of these experiments, in short, contradicts the notion of mycorrhizal symbiosis as a process of value to the host.

Potatoes.—*Bull. Me agric. Exp. Sta.* 420, pp. 419–482, 4 figs., 1943.

R. BONDE states that much progress has been made in the improvement of potato seed stocks in Maine as regards freedom from ring rot [*Corynebacterium sepedonicum*: *R.A.M.*, xxiii, p. 118], no complaint having been received regarding 18,000 truckloads of certified seed recently exported to other States.

In studies by R. BONDE and S. SNIESZKO it is stated that a seed stock with an occasional diseased tuber will usually show 1 per cent. ring rot at harvest, and 10 or 15 per cent. rot or even more when planted successively for two or three years.

During 1942, some 3,500 seedling potato varieties were tested for resistance to ring rot, and two foreign varieties and four potato seedlings were found to be resistant.

Tissue extracts of different potato varieties after passage through bacteriological filters showed striking differences in their ability to support growth of *C. sepedonicum*. SNIESZKO found that the addition of sodium dichromate (1 : 20,000) [to the media] made it possible to isolate the ring-rot organism from rotted tubers with advanced secondary decay. Skim milk with added litmus was used as a medium in which the stock cultures of *C. sepedonicum* remained viable for months. Preliminary tests indicated that the ring-rot organism forms a uniform serological group, and that the agglutination test may be used to identify this bacterium. This may mean that a resistant variety is resistant to the disease whatever the source of the organism. In preliminary experiments on the survival of *C. sepedonicum* under various conditions the organism survived for several months on bags made of cotton or jute but died off in a comparatively short time on wooden toothpicks [cf. ibid., xxiii, p. 38].

In test-tube experiments by SNIESZKO the growth of *C. sepedonicum* was completely suppressed by crystal violet (1 : 1,000,000), brilliant green (1 : 100,000), fuchsin (1 : 100,000), trypan blue (1: 5,000), coal tar disinfectant (1 : 10,000 to 1 : 50,000), semesan bel (1 : 1,000 to 1 : 5,000), mercuric chloride (1 : 10,000), cupric sulphate (1 : 1,000 to 1 : 5,000), phenol (1 : 1,000), 4-tertiary-butyl-meta-cresol (Kopper's) (1 : 5,000 to 1 : 10,000), U.S. rubber germicide No. 83 (1 : 5,000), and U.S. rubber germicide No. 590 (1 : 1,000).

Some of the newer potato varieties, such as Katahdin, Chippewa, and Houma are susceptible to leaf roll but do not develop net necrosis in the tubers. These varieties may be considered to be resistant to leaf roll to this extent, but it is quite possible that varieties with greater resistance may be developed. Other methods include aphid control, isolated seed plots, roguing, and early harvesting. D. FOLSOM states that several thousand seedlings have been tested for resistance to leaf roll over a number of years. During the 1941 growing season at Highmoor Farm, 79 per cent. of the Green Mountain potatoes, 91 per cent. of the Chippewa, and 85 per cent. of the seedling varieties contracted the disease.

D. FOLSOM and M. GOVEN found that samples from fields which apparently had considerable leaf roll showed much net necrosis even at storage temperatures of 31° to 36° F. Potatoes from one field had 36·2 per cent. net necrosis when stored at 53°, and only 15·3 per cent. when stored at 31°, while the figure was 20 per cent. at 36°. Potatoes from another field showed 0·7 per cent. net necrosis at 36° and 15 per cent. at 53°. When potatoes were kept at about 70° for 60 days, and the storage temperature was then reduced to about 51°, much less net necrosis developed than was the case when other samples from the same lots were held continuously at 51°.

A. F. ROSS and M. T. HILBORN state that Green Mountain potatoes stored at 32° did not develop mahogany browning [ibid., xxii, p. 221]. Chippewa potatoes with leaf roll usually showed a more severe discoloration in the cortex than else-

where in the tuber, while healthy Chippewa generally displayed the discoloration only in the vascular ring and pith. In most instances, the pith was the most severely affected part, the discoloration appearing as scattered spots. There was a difference of six or seven weeks in the time taken for the symptoms to appear as between tubers grown at Highmoor Farm and those grown in Aroostook County, but before the end of the storage period the percentage of affected tubers was about the same from all sources.

R. Bonde and G. W. Simpson report that leaf roll and net necrosis are often limiting factors in the production of Green Mountain potatoes for market. The presence of a relatively small amount of net necrosis in table stock potatoes puts them out of U.S. 1 grade, while buyers expect seed potatoes to be relatively free from leaf roll and net necrosis. In 1940, the ratio of net necrosis to leaf roll in Green Mountain potatoes was found in one test to be 1 : 4·51, while in 1941, it was 1 : 2·82.

D. Folsom and M. Goven found that the incidence of stem-end browning [ibid., xxi, p. 322; xxii, p. 221] varies from one field to another. In storage at 52°, potatoes from two fields showed 40 and 6 per cent. stem-end browning, respectively. Scarcely any was found at digging time in four fields under observation, the soil temperature being (at digging) rather below the optimum for the condition. In storage at 36° samples from four fields 90 days after digging showed, respectively, 1·7, 1·6, 1·5, and 0·4 per cent. stem-end browning, while other samples from the same fields, but stored at 51° to 53° had, respectively, 21·7, 39·5, 6·4, and 15·9 per cent. Other lots from the same fields kept for 60 days at 70° and then for 30 days at 50° to 51° had, respectively, 1, 0·9, 2·1, and 1·8 per cent. stem-end browning; yet others from the same fields held at 53° to 55° for 30 days had, respectively, 8·2, 23·3, 4·8, and 5·1 per cent., as against 21·7, 39·5, 6·4, and 15·9 per cent. for lots kept at 51° to 53° for 90 days.

Experiments in 1941 by R. Bonde and H. R. Shepherd indicated that the concentration of Bordeaux mixture may be reduced from 10–5–100 to 8–4–100 with no significant diminution in yield or blight control. In 1942, Bordeaux mixture 4–2–100 applied with a tractor spray did not control infection when the weather conditions favoured the disease and the source of infection was heavy and close at hand; this low concentration did, however, give moderately good control in plots remote from a heavy source of infection. The yield per acre was not reduced when the 4–2–100 formula was used. It would seem that many growers who use tractor-power spray machines are applying much more Bordeaux mixture than is necessary or advisable. When a horse-drawn wheel-traction outfit was employed, which supplied 90 gals. of spray per acre, as compared with 140 gals. from the tractor-power machine, all the formulae used (10–5–100, 8–4–100, 6–3–100, and 4–2–100) gave satisfactory control, the best results being given by the 10–5–100 treatment (protective coefficient, 1). At 8–4–100, the protective coefficient was reduced to 0·9, at 6–3–100 it was 0·83, and at 4–2–100 it was 0·62. The plots sprayed with 10–5–100 gave 30 bush. per acre more potatoes than those sprayed with 8–4–100. The other reduced concentrations gave corresponding reductions in yield. It is concluded that the copper content of Bordeaux mixture used for spraying potatoes can be materially reduced if a tractor-power machine is used.

R. Bonde and S. Snieszko state that purple top [loc. cit.] is not caused by a species of *Rhizoctonia*. The seed tubers from affected plants either fail to grow or produce only small fine sprouts and plants. Two helpful methods of reducing losses are (1) to rogue all affected plants, and (2) to allow the seed stock to sprout slightly and discard the tubers that produce weak sprouts.

E. R. Tobey, B. E. Plummer, and R. Bonde state that white distilled vinegar satisfactorily maintained the mercuric chloride strength of dipping solutions used to disinfect seed potatoes.

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REED (G. M.). **Phytopathology—1867–1942.**—*Torreya*, xliii, 2, pp. 155–169, 1943.

In this paper the author reviews the history of phytopathological research from 1867 to 1942, the main points dealt with being the life-history and classification of the fungous pathogens, physiologic specialization, the importance of environmental factors in relation to disease outbreaks, bacterial and virus diseases, breeding for resistance, methods of disease control, and research and teaching.

LEACH (J. G.) & MULLIN (J. R.). **The daily flight of Aster leafhoppers as determined by a light trap.**—*Bull. W. Va Univ.*, Ser. 42, 8–11, pp. 93–95, 2 graphs, 1942.

As one phase of a comprehensive study of the blue stem or purple top wilt disease of potatoes [*R.A.M.*, xxii, p. 493], the writers have investigated the migration of the aster leafhopper, *Macrosteles divisus*, from cereals and grasses to potatoes over the period from May to August, 1939 and 1940, and the factors controlling their movements. The insects were much more numerous in 1939 than in 1940, and the incidence of purple top was correspondingly higher in the former than in the latter year. There were two distinct peaks of migration in both years, but they fell at different times and yielded no evidence of any inherent tendency to move at a given moment, neither was any influence of maturity of the alternate hosts on the migration of the leafhoppers to potatoes apparent.

LOUGHNANE (J. B.). **Aphis rhamni Boyer; its occurrence in Ireland and its efficiency as a vector of Potato viruses.**—*J. Dep. Agric. Éire*, xl, 2, pp. 291–298, 1943.

A survey of the aphis population of potato crops carried out during 1938, 1939, 1940, and 1941 in Eire showed that *Aphis rhamni* occurs in large numbers in several seed-growing districts. The capacity of this species, whose life-history, world distribution, and description are given in detail, to transmit potato viruses was experimentally established during 1940 and 1941. The results suggest that *A. rhamni* is a more efficient vector of virus Y than of leaf roll, and, as indicated by a single experiment, is not as efficient a vector of leaf roll as *Myzus persicae*. No precise information is available on the effectiveness of *A. rhamni* under field conditions. However, there are certain factors, such as lateness of arrival and the tendency to remain on the leaf on which it was produced, which would tend to operate against any large scale transmission by this species. It is, therefore, concluded that *A. rhamni* is of no importance as a vector of potato viruses in the field. This view is supported by the fact that in the districts where this aphis occurs abundantly, seed potatoes have been grown for many years without any noticeable increase in the incidence of virus diseases in the crops.

BALD (J. G.) & NORRIS (D. O.). **Transmission of Potato virus diseases. 1. Field experiment with leaf roll at Canberra, 1940–41; 2. The aphis population of Potatoes at Canberra, during 1940–41.**—*Bull. Coun. sci. industr. Res. Aust.* 163, 31 pp., 5 graphs, 2 diags., 1943.

In this paper are described the first controlled experiments on the spread of

potato leaf roll in Australia [*R.A.M.*, xxiii, p. 74]. Steep gradients of infection suggested a limited range of dispersal of the aphis vectors. In the first of the two experimental blocks of plants, adjacence to a leaf roll plant appeared to have little influence on the likelihood of a healthy plant becoming infected; in the second, the percentage of infection among healthy plants adjacent in the same row to a diseased one was higher than among more distant ones. Analysis of the figures for the latter block suggested that direct transmission from original sources to neighbouring plants in the same row would account for about 80 per cent. infection among those plants, the effect of this type of transmission falling off very rapidly with increasing distance from the sources. It is assumed that the figure for direct, or neighbour, infection represents short-range dispersal of the virus mainly by wingless aphids crawling from diseased to healthy plants. It was calculated that indirect or secondary infection alone would have accounted for an average of 66 per cent. infection throughout the block. This type of transmission, from unidentified sources, may be due to either the dispersal of winged aphids, to secondary infections from plants infected during the current season, or to the infection of plants progressively more distant from the original source by infective aphids migrating considerable distances along rows and feeding successively on a number of plants.

Discussing the variations in the populations on potato of the two leaf roll vectors, *Macrosiphum gei* and *Myzus persicae*, relative to season and weather, the author states that hot, dry weather depresses the population of both species. Use was made of the ratio of immature to adult forms as a multiplication index in comparing populations. Inverse variations in the numbers of the two species are explained on the basis of greater destruction of adults of *Macrosiphum gei* and nymphs of *Myzus persicae* by heavy rain. The observed concentration of population of *Macrosiphum gei* on the bottom leaves of potatoes, which is the reverse of the condition reported in other countries, is believed to be due to a decreased rate of mortality in this region of the plant.

Younkin (S. G.). **Diseased Daisies menace upstate Potato crop.**—*Fm Res.*, ix, 3, pp. 6–7, 2 figs., 1943. [Abs. in *Exp. Sta. Rec.*, xc, 1, pp. 66–67, 1944.]

Clovers have generally been assumed to serve as alternate hosts and perpetuate the virus of yellow dwarf [*R.A.M.*, xxii, p. 399], one of the most serious of the 20 or more virus diseases of potatoes occurring in New York, especially from the standpoint of certified seed production. It has lately been observed, however, that potatoes separated by many miles from clovers may become infected, and 45 out of 137 weeds tested for the presence of yellow dwarf were shown to be capable of harbouring the virus. Under field conditions, only one out of 842 medium red clover plants was found to be infected, and none of the 544 of two other clover species carried the virus. In the same fields, of 374 plants of *Chrysanthemum leucanthemum* var. *pinnatifidum* 168 were infected, of 211 of *Rudbeckia hirta* 1, of 287 of *Barbarea vulgaris* 3, and of 1,324 of eight other species none. Infected plants of *C. leucanthemum* var. *pinnatifidum* are able to survive the winter with a relatively low mortality rate. Migration of the clover leafhopper [*Aceratagallia sanguinolenta*] vector to potato fields reaches a climax during periods of drought or at times when preferred food plants are scarce. The maximum infection of potatoes consequently occurs in dry seasons, and the heaviest losses are experienced in the following year when diseased tubers are planted. Of the potato varieties commonly grown in the State, Green Mountain and Rural are the most susceptible and Katahdin and Sebago [ibid., xxiii, p. 185] among the most resistant to yellow dwarf. Care should be taken to avoid planting susceptible varieties adjacent to fields containing large populations of *C. leucanthemum* var. *pinnatifidum*: where

isolation is impracticable, seed should be saved only from the centre of the field, and in all cases the numbers of perennial weeds should be reduced to a minimum.

WALLACE (MAUD M.). **Diseases of Potatoes.**—*Mycol. Leafl. Dep. Agric. Tanganyika* 17, 10 pp., 1943.

In connexion with the first appearance of potato late blight (*Phytophthora infestans*) in the Northern Province of Tanganyika in 1942 [*R.A.M.*, xxii, p. 493], and its subsequent spread to the Usambara and Uluguru Mountains, the writer describes in popular terms the symptoms of this disease and other well-known pathogens of the same crop in the Territory, and gives directions for their control, largely by improved cultural methods, supplemented in the case of late blight by spraying or dusting with copper-containing compounds. The other potato diseases discussed are early blight (*Alternaria solani*), *Sclerotinia sclerotiorum* (found once, in 1943, in the Moshi district), black scurf and stem canker (*Corticium solani*), troublesome in parts of the Usambara Mountains, *Sclerotium rolfsii*, first observed in the Territory in 1943, black dot (*Colletotrichum atramentarium*), common scab (*Actinomyces scabies*), powdery scab (*Spongospora subterranea*), mosaic, internal brown fleck [ibid., xvii, p. 160], spraing, and storage rots, including *Fusarium coeruleum*.

FERNOW (K. H.). **Potato ring rot control for those who think they don't have the disease.**—*Amer. Potato J.*, xxi, 1, pp. 14–17, 1944.

A five-year programme is outlined for the production of seed potatoes, to be applied only where ring rot [*Corynebacterium sepedonicum*: *R.A.M.*, xxiii, p. 118] is believed to be altogether absent or present in not more than one hill in 10,000. The first year, 100 hills should be dug by hand, each being examined for symptoms of ring rot. If any are found, the attempt should be abandoned. Assuming that 100 healthy hills have been dug, the tubers should be picked directly into new crates and stored in these through the winter. Next year the tubers should be cut with a knife which has been previously disinfected in boiling water for five minutes and planted by hand to avoid danger of transferring infection from other plots. The resulting plot should consist of 1,000 hills (or more). Of these, 100 hills (preferably those first planted) should again be dug by hand in the autumn, and the remainder with a digger, with due precautions to prevent contamination in field or storage. The third year, a 1,000-hill plot should be planted with the product of the 100 hills dug by hand the previous year and a one-acre plot planted with the product from the remainder. This should be repeated yearly till the original 100 hills expand to 100 acres after about five years. The method has not been tested experimentally but is proposed as a practical aid to seed-growers until better methods are worked out.

LECLERG (E. L.). **Non-virus leafroll of Irish Potatoes.**—*Amer. Potato J.*, xxi, 1, pp. 5–13, 4 figs., 1944.

A non-virus leaf roll, very similar to that caused by the virus, is stated to occur frequently in Irish potato seedling varieties under southern conditions in Louisiana, and to appear nearly every spring in first-tuber propagations from seedlings grown from true seed the previous autumn. The nature of the disease is not yet completely understood, but it appears to be an inheritable character and its expression is probably conditioned by environmental factors and the interaction of length of storage period and dormancy. Marked differences in the degree of rolling were found in both seedling and named varieties of Irish potatoes, a few of those tested being relatively free from the trouble. Progenies from crosses and inbred lines differed considerably in the percentage of segregates subject to rolling. Freedom from rolling was inherited by a high percentage of the progeny in a few

crosses or inbreds, indicating possible lines of potato-breeding work. The assumption of a non-virus nature of the disease rests on the following facts: (1) no appreciable increase of rolling occurs with continued propagation; (2) the percentage of primes is maintained with continued propagation; (3) almost without exception every plant of a given variety, if subject to rolling, is affected to approximately the same degree; and (4) stem-graft tests substantiate observational differentiation between non-virus and virus leaf roll to a high degree.

TURNER (C. N.). **Custom Potato spraying in New York aids the war.**—*Amer. Potato J.*, xxi, 1, pp. 17–20, 1944.

During the last three years a type of sprayer new to New York State (but used in Maine since 1931) is stated to have facilitated the organization of a large spraying-service ring, where a large group of potato growers can be served by one spraying outfit. The number of these outfits has increased from 12 in 1941 to 35 in 1943, with a probable total of 70 for 1944. These 70 outfits are expected to spray about 17,000 acres. The new type consists of a ten-row tractor-mounted sprayer and a water-supply truck equipped with a large tank and water-pumping appliances. The outfits are usually owned by the operator who, with his helper on the truck, sprays the grower's potatoes from six to eight times at 7- to 10-day intervals throughout the season, at a cost of about $2.00 per acre for each 10 : 10 : 100 Bordeaux application. The outfit is very compact and manœuvrable and can be guided between the rows better than any other type of field-sprayer. The outfit is far superior to anything a small grower could afford to own, and operates at smaller cost, which is even further reduced when operators use the tractor to plough, harrow, plant, and dig as well as spray.

HARTMAN (L. E.). **Potato wart in Pennsylvania.**—*Proc. Pa Acad. Sci.*, xvii, pp. 71–77, 2 maps, 1943.

Since 1918, when potato wart [*Synchytrium endobioticum*] was first detected in Pennsylvania, annual surveys for the presence of the disease have been conducted, and up to and including 1942 a total of 1,031 infected gardens had been located in 77 towns or villages in 15 counties. The present quarantine areas comprise the whole of four townships and 29 scattered towns and villages in ten counties. All wart surveys are now limited to areas where mean soil temperatures favour or permit the development of the pathogen, i.e., those with a growing season of 140 days or less. Since 1936 no new foci were discovered until August, 1942, when the disease was observed over a radius of one mile at an elevation of 2,000 to 2,200 ft. in adjoining sections of Susquehanna, Lackawanna, and Wayne Counties, the number of gardens involved being 102 out of 457 planted.

The following salient facts have emerged from the researches of the Department of Agriculture. Wart disease, unless transported by artificial means, spreads very slowly. The fungus persists for many years in favourable soils and will rapidly re-establish itself. Soil temperatures are a limiting factor in the development of *S. endobioticum*, which thrives at 60° to 64° F. and is inhibited at 70° to 74°. Several commercial varieties, e.g., Green Mountain, Cobbler, and Spaulding Rose, are immune, but 90 per cent. of those grown in the State are susceptible. Eradication by chemical treatment of infested soils has given encouraging results in plot and field tests, complete freedom from wart having been obtained, for instance, by the use of ammonium thiocyanate [*R.A.M.*, xix, 426] at the rate of 2,000 lb. and upwards per acre, followed if necessary by 'spot treatment' (of individual infected hills and adjoining soil for a radius of 9 sq. ft.) with mercuric chloride. In the large eastern wart area of the State, embracing 752 infested gardens in 42 towns and villages, which has been under quarantine for 20 years and where only immune varieties are grown, 50 per cent. or more of the gardens are now

estimated to be entirely free from the disease, while in perhaps half the remainder infection is so slight that 'spot treatment' will probably suffice for complete eradication. A re-survey of this area in 1940 further showed that 210 infected or suspected gardens had been eliminated by culm dams, stripping operations, and the like.

JODON (N. E.) & BEACHELL (H. M.). **Rice dwarf mutations and their inheritance.**—*J. Hered.*, xxxiv, 5, pp. 155–160, 3 figs., 1943.

Four types of dwarf mutations in rice [cf. *R.A.M.*, xxi, p. 96], viz., thickset, intermediate, grassy, and double, were collected in Texas, Arkansas, and Louisiana between 1936 and 1941. In crosses with normal plants, thickset and grassy behaved as simple recessives. The F_1 plants of grassy × thickset were of normal height, while the F_2 revealed a 9 : 3 : 3 : 1 ratio of normal, grassy, thickset, and double dwarf, respectively, the last-named appearing as a double recessive class.

TRUNINGER (E.). **Versuche und Untersuchungen über die Wirkungen des Bors als Spurenelement.** [Experiments and studies on the effects of boron as a trace element.]—*Annu. agric. Suisse*, lviii, 1, pp. 1–36, 9 figs., 1944. [French summary.]

A whole group of non-parasitic plant diseases formerly attributed to lime injury or an excessively alkaline soil reaction has now been recognized as proceeding from boron deficiency, and hence curable by the application of boron-containing fertilizers. The element is present in all cultivated soils, originating for the most part in tourmaline, an aluminium-boron silicate encountered in the majority of rocks. Tourmaline itself, however, owing to its slowness of disaggregation, is not a very good direct source of boron, even large quantities of the mineral, in a finely pulverized state, failing to compensate for the lack of boron on a limed, slightly acid soil. On soils of this type, boron alone or in conjunction with a complete fertilizer of neutral reaction has effected no improvement, except in the case of plants with an exceptionally high boron requirement, such as beets. Only after the treatment of the soil with large quantities of lime, inducing an alkaline reaction and consequent injury to the crops from boron deficiency, did the application of the latter element arrest the falling-off in yield or even produce a substantial increase.

In fertilizer experiments with a number of vegetable, fodder, and cereal crops, boric acid, even at the minimum rate of 5 kg. per ha., increased the boron content of the plants, in most cases by several times the normal amount. The multiplication of the element was chiefly conspicuous in the vegetative organs, but its beneficial effects were primarily noticeable in the reproductive system. The addition of lime to the boron fertilizer proved to be not only unnecessary, but in some cases even detrimental. Cereals, the poorest in boron of all the plants investigated [*R.A.M.*, xvi, p. 582], were the least affected either by over-liming or the administration of a boron fertilizer. The application of lime nearly always caused a more or less acute shortage of boron in the plants so treated, usually coupled with an increase of nitrogen. After being supplied with boron, the plants were able to make a more economical use of the nutrients comprised in the remaining constituents of the fertilizer, i.e., they required smaller amounts of mineral substances for the production of a unit of dry matter. The proportion of boron withdrawn during growth by the various crops normally ranged from 5 to 20 per cent. of the quantity supplied, though in exceptional cases these percentages were exceeded, e.g., by field [broad] beans (42·3) and buckwheat (55·3). The after-effects of boron have not yet been adequately investigated, but the element is unlikely to persist for more than two or three years in the soil owing to the ease with which the borates are washed out.

In pot experiments with mustard on the effect of simultaneous increases in the dosage of boron and carbonate of lime, very good results were obtained with a minimum dose at the rate of 5 kg. per ha. (0·0157 gm. per pot) of the former (as boric acid) in proportion to the maximum application (50 gm. per pot) of the latter. At the rate of 50 kg. per ha., boron caused a reduction of yield, with a correspondingly more severe drop at the 100 kg. dose. The maximum total (seed and straw) yield of 48·9 gm. per pot was secured by the incorporation with the soil of 50 gm. lime and boric acid (at the rate of 25 kg. per ha.), closely followed by yields of 46·4 and 43·7 gm. resulting from a combination of 25 or 5 gm. lime and boric acid at the 5 kg. rate respectively, with a minimum of 14·5 gm. (all straw) with no lime and boric acid at 100 kg. It is apparent from these figures that plentiful liming is an essential accompaniment to the boron treatment, which should not be regarded as an economical substitute for other fertilizers.

The deficiency of boron in the soil after heavy lime applications is attributable to the absorption of the former by the sesquioxides, which are precipitated by the development of an alkaline reaction. There is no question of the formation of semi-insoluble calcium borates. Unlike lime carbonate, gypsum even in large quantities causes no boron shortage.

The superiority of Chile saltpetre to the synthetic sodium saltpetre rests on the boron content of the natural product, the differences in the action of the two fertilizers on flax, mustard, and tomatoes being particularly noticeable on freshly limed soil. The addition of boron to synthetic sodium saltpetre equalizes the disparity. Besides Chile saltpetre, light ashes from cement works are the only mineral fertilizer in common use containing appreciable amounts of boron, but in tests on mustard and beet the beneficial effects of this product were too slight to be of any practical importance. In experiments on flax the yield was increased by treatment of the soil with liberal doses of boron-containing marl, in which the element occurs in excessively fine particles and is therefore more effective than equivalent amounts of borax or boric acid.

Symptoms of boron deficiency include poor root development, the system consisting merely of a few thread-like, brown roots and minute laterals with short clubbed ends, e.g., in flax, lucerne, mustard, carrots, and radishes, accompanied in the two last-named by gaping longitudinal fissures and cup-shaped depressions; absence of bacterial nodules in the Leguminosae; reduction of the leaf surface, an abnormally dark green coloration, frequently combined with increased pubescence and lustre as aids to transpiration; an erect position of the leaves; the attempted replacement of the main shoot and growing point by the continuous production from the rootstock of abortive adventitious shoots (this phenomenon is particularly characteristic of flax and barley, and has also been observed in cases of beet heart and root rot); and most important of all, scanty flower and fruit growth, especially involving the petals and stamens.

Pinck (L. A.) & Allison (F. E.). **The synthesis of lignin-like complexes by fungi.**—*Soil Sci.*, lvii, 2, pp. 155–161, 1944.

The synthesis of lignin-like complexes by 12 cultures of Hyphomycetes grown on a mineral-sucrose medium was investigated and the average percentage values found were as follows: *Cladosporium* sp. and *C. fulvum*, 21·1; *Helminthosporium* (two isolates), 19·0; *Humicola* sp., 8·1; *Dematium* [*Pullularia*] *pullulans*, 7·1; *Alternaria*, 6·8; *Aspergillus niger*, *A. giganteus*, *Gliocladium fimbriatum*, 2·4, and *Metarrhizium*, 3·6, these figures representing the non-nitrogenous portion of the fungal substance that resisted digestion with 72 per cent. sulphuric acid. Generally speaking, the black or brown fungi contained larger proportions of lignin complexes than the colourless or pale ones.

Under optimum growth conditions, i.e., at or just above P_H 7 and in the presence

of sufficient trace elements, some 40 to 50 per cent. of the carbon of the sucrose was converted into cell material by *C.*, *H.*, and *G.* spp., the corresponding values for the remaining organisms ranging from 25 to 30 per cent. The carbon : nitrogen ratios of the fungal material varied between 10·7 and 22·4 per cent., with an average value of 15·3.

Since the high-lignin organisms grow chiefly on rotting vegetation at or above soil-level, the kind of system used in stubble mulch or trash mulch farming would be expected to promote an abundant yield of humus.

MUNDKUR (B. B.). **Tilletia tumefaciens, a remarkable gall-forming smut from India.**—*Phytopathology*, xxxiv, 1, pp. 143–146, 2 figs., 1944.

The writer has recently published a description [*R.A.M.*, xx, p. 179] of the unique gall-forming smut, *Tilletia tumefaciens* Syd., abundant material of which was collected in 1942 at Rohtak, 30 miles west of New Delhi, on a medicinal plant, *Panicum antidotale*. The pathogen attacks the basal axillary buds, causing them to swell into a globose, black mass, consisting of several united galls simulating a single one. In severe cases the central bud enlarges into a finger-like tumour containing the kaiser-brown to hazel (Ridgway), reticulate spores, nearly black in the mass, which measure 16 to 23 (mean 19·3 μ) in diameter. Three to five such tumours may be seen emerging at one node when several buds are infected. The scale leaves become hairy, swollen, considerably elongated, and completely occupied by the spores of the smut. The powerful trimethylamine odour [ibid., xi, p. 775; xii, p. 277] characteristic of wheat bunt [*Tilletia caries* and *T. foetida*] emitted by the galls attracts insects, which disseminate the spores over considerable distances.

Briefly discussing the limits of the genus *Tilletia*, the author points out that its proposed restriction by Ciferri to the ovariicolous smuts [ibid., xvii, p. 841] fails to recognize the basis of the separation of the Tilletiaceae from the Ustilaginaceae on spore germination and other morphological characters rather than on the location of the sori in the host.

OSORIO TAFALL (B. F.). **La gomosis de la Caña de Azúcar.** [Sugar-cane gummosis.] —*Fitófilo*, ii, 1, pp. 61–82, 7 figs., 1943. [Abs. in *Exp. Sta. Rec.*, xc, 1, p. 67, 1944.]

In this general account of sugar-cane gummosis (*Phytomonas vascularum*) [*Xanthomonas vasculorum*], the author treats of the disease under the aspects of its geographical distribution, etiology, symptomatology, morbid anatomy, natural and artificial transmission, varietal reactions, alternate hosts, and preventive measures. A bibliography of 30 references is appended.

YAMAFUGI (K.), SO (K.), & NAGANO (K.). **Über Atmung und Katalasewirkung beim viruskranken Zuckerrohr.** [On respiration and catalase action in virus-diseased Sugar-Cane.]—*Biochem. Z.*, cccxv, 5–6, pp. 405–410, 1943.

A tabulated account is given of experiments conducted at the Imperial University, Fukuoka, Japan, the results of which showed the catalase activity of mosaic-diseased sugar-cane leaves to be much weaker than that of healthy ones. For instance, reckoning the catalase activity of a sound leaf at 100, the corresponding figure for an infected one was 61. Evidence was further secured pointing to the enclosure of the host cell catalase in the high-molecular virus protein during the process of virus multiplication, so that the activity of the enzyme can only be exerted under appropriate conditions after the splitting-up of the virus.

RISCHKOV [RYJKOFF] (V. L.) and VOVK (A. M.). **Biological activity of acyl derivatives of the virus of Tobacco mosaic.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxxviii, 7, pp. 221–222, 1943.

In experiments conducted at the Institute of Microbiology, Moscow [*R.A.M.*, xxiii, p. 81], inoculations of tobacco and tomato plants with benzoylized and acetylized derivatives of tobacco mosaic virus were as successful as those with the normal virus itself, and the symptoms produced were identical in both cases. Inoculations of a new lot of tobacco and tomato plants with the juice from plants infected with the acyl derivatives were again as successful as those with the juice infected with the normal virus itself, indicating that acyl derivatives are as fully infective as the normal virus and capable of producing the same symptoms. It is assumed that within the plant into which these derivatives are introduced, the production of normal virus molecules takes place, and it is suggested in explanation of this phenomenon that the acylated molecule of the virus undergoes saponification in the living vegetable cell and hence is regenerated into its normal state.

MCKINNEY (H. H.) & CLAYTON (E. E.). **Acute and chronic symptoms in the Tobacco ring-spot disease.**—*Phytopathology*, xxxiv, 1, pp. 60–76, 4 figs., 1944.

Tobacco ring-spot virus, like tobacco yellow mosaic virus [*R.A.M.*, xxiii, p. 153], produces two phases in Samsun tobacco, namely, acute with pronounced symptoms and chronic, in which the expression of infection assumes a milder form. The two diseases represent different levels of disease expression. In the case of yellow mosaic, the level of plant resistance was so low that even in the chronic phase the reduced disease reactions were very marked, whereas in ring spot the level of resistance was so high that ring spot and mottling did not develop in the chronically infected leaves of Samsun and other varieties, including T.I.448 A and selections from this genotype, which is highly resistant to mosaic.

So strong was the resistance of Swiss Giant pansies (*Viola tricolor*) that typical ring-spot symptoms did not appear in any form, even though the virus invaded the inoculated plants. On the other hand, in the Early White Spine cucumber, the level of resistance to ring spot was sufficiently low to permit the development of mosaic mottling throughout most of the chronic phase. The virus reduced the green weight of the plants by some 97 per cent., the decrease being reflected in the smaller size of the leaves and in the shortness and slenderness of the runners. In Scotia beans local lesions were formed on the primary leaves inoculated with ring spot, systemic infection by which was more rapid at near 33° C. than at 22·5°, acute necrosis involving the secondary leaves and stem and finally destroying the entire plant at the former temperature.

Further evidence of resistance to ring spot in tobacco was afforded by the necessity of large quantities of inoculum and ideal cultural conditions to insure strong acute reactions, especially in the case of older plants, in which, moreover, chronic symptoms were erratic or absent unless an abundant supply of the virus was forced into the very young apical tissues. The level of virus synthesis in ring spot would thus appear to be relatively low, the meristematic tissue only being invaded with difficulty. Once invasion has taken place, however, the subsequent young leaves contain very few virus-free areas. As in the case of yellow mosaic [loc. cit.], the inoculation of chronically diseased leaves with the ring-spot virus did not induce the primary acute reactions resulting from the similar treatment of healthy foliage.

The data obtained in these studies are regarded as confirming already available evidence of a clear distinction between the suppression of external symptoms in chronic diseases and acquired immunity.

VALLEAU (W. D.), JOHNSON (E. M.), & DIACHUN (S.). **Tobacco leafspot bacteria on roots of pasture plants.**—Abs. in *J. Bact.*, xlvii, 2, p. 214, 1944.

Previous studies at the Kentucky Agricultural Experiment Station showed that *Bacterium* [*Pseudomonas*] *tabacum* and *Bact. angulatum* [*P. angulata*] multiply on the roots of several crop plants and weeds, and may persist over winter in this way on the roots of cover crops planted in succession to tobacco [*R.A.M.*, xxiii, pp. 59, 192]. Later investigations have demonstrated the capacity of *P. angulata* to persist on wheat and crimson clover [*Trifolium incarnatum*] roots for at least $1\frac{3}{4}$ years after tobacco harvest. Inoculations from soil cores containing roots from bluegrass [*Poa pratensis*] fields in which tobacco beds were prepared showed the bacteria to be present, presumably on the roots of certain pasture plants, before the appearance of the diseases in the plant bed. *Pseudomonas tabacum* was likewise obtained from weed roots in a field prepared for setting tobacco at the time when the latter operation was taking place.

WALLACE (J. M.) & LESLEY (J. W.). **Recovery from curly top in the Tomato in relation to strains of the virus.**—*Phytopathology*, xxxiv, 1, pp. 116–123, 1 fig., 1944.

In 1941 five, and in 1942 three virulent strains of the [sugar beet] curly-top virus were singly inoculated into Guasave-A tomato plants at the California Citrus Experiment Station, Riverside. In both years, there were some conspicuous differences in the reactions of the plants inoculated with the several strains, such variations being, in general, consistent in the two seasons. The virulence or mildness of the individual strains decisively influenced the degree of recovery among the diseased plants, those infected by strain 3, for example, being noticeably superior in recuperative capacity to those of all other groups, besides showing much less severe symptoms than those attacked by strain 9 or 58. In 1941, the percentages of plants recovering from infection by strains 3, 9, and 58 were 100, 88·6, and 80, respectively. Most of the plants inoculated with strains 5 and 75 fell into the small or moderate recovered growth classes. In 1942, recovery was again most advanced in the group of plants infected by strain 3, followed by 9 and 58, the differences between which were only slightly in favour of the former. At the same time (74 days after inoculation), the condition of the plants inoculated with a mixture of the three strains was about equal to that of the 58 group. While no conclusive explanation of the high interannual variability in the percentage of recovery of Guasave-A tomato plants observed in 1939 and 1940 is forthcoming, the above results suggest that the strain of virus, as well as environmental conditions, determine the percentage of plants recovering.

DAVIDSON (R. W.) & CAMPBELL (W. A.). **Observations on a gall of Sugar Maple.**—*Phytopathology*, xxxiv, 1, pp. 132–135, 2 figs., 1944.

Globose or fusiform galls, often bearing one or more cankers, are fairly prevalent on sugar maple (*Acer saccharum*) trunks in the Kane Experimental Forest, Pennsylvania, and the adjacent Allegheny National Forest, and have also been observed in New York and New England. The same type of excrescence is designated 'globose canker' by Lorenz and Christensen in their survey of forest tree diseases in the Lake and Central States [*R.A.M.*, xvii, p. 277]. The galls occur on trees from 2 to 18 in. in diameter at breast-height, mostly on stems 4 to 8 in. in diameter, and are nearly always found on the main trunk, 6 to 8 ft. from the ground, from one to four developing on a single maple. In the early stages, the bark covering the hypertrophied part is often smooth or only slightly furrowed, but the larger galls are usually much fissured, while dead streaks tend to develop on one or more sides; these sometimes heal over, producing elongated ridges, but the

surface seldom remains long unbroken owing to the further activity of the agent of the swelling, and the tree may gradually become girdled and die through persistent necrosis of the cambium. The greenish-black streaks in the wood underlying the galls are strongly reminiscent of those termed 'mineral stain' [ibid., xxiii, p. 201]: the dark stained wood remains very hard and heavy.

Of the various organisms isolated from the central area of discoloration, the most common were a slow-growing bacterium resembling one associated with red heart in birch and *Torula ligniperda*, another concomitant of the same disease [ibid., xx, p. 326], while a species of *Coniochaeta* and *Coryne sarcoides* were also occasionally present. None of these entities having been isolated from the advancing margin of diseased tissue, their connexion, if any, with the death of the sapwood must be indirect. The activity of the pathogenic agency continues in narrow stripes, on both sides of which dead areas have developed in the cambium. Leaving aside the question of its identity, the causal organism of the galls appears to gain ingress to the stem at an early stage in the life of the tree, to work slowly outwards through the living sapwood, and gradually to encroach to within a few or even 1 mm. of the cambium, with a resultant stimulation to growth at that point.

Gall-bearing trees are not promising subjects for timber production, and may be used as cuttings for chemical or fuel wood. The gall-forming organism is obviously not of a highly virulent order, since the numerical increase of affected trees in a stand takes place at a very slow rate.

GRAVES (A. H.). **Chestnut breeding work in 1943.**—*Rep. Brooklyn bot. Gdn, 1943* (*Brooklyn bot. Gdn Rec.*, xxxiii, 1), pp. 11–13, 1944.

The work of interhybridization among indigenous chestnuts and back-crossing the resultant progeny with selected Japanese and Chinese individuals with a view to the development of a tall timber type possessing immunity from blight [*Endothia parasitica*] proceeded along the usual lines in 1943 [cf. *R.A.M.*, xxii, p. 411]. The F_1 hybrids were maintained in a vigorous condition by inarching the basal shoots, thereby bridging over the lesions inflicted by the fungus. Since nearly all the grafts made by this method in 1943 were successful, a good supply of suitable breeding stock is available. Inoculation experiments are in progress to determine the reactions of the hybrids to *E. parasitica*.

HUBERT (E. E.). **The curl test. Method for rapidly determining water repellancy of preservatives in wood.**—*Timberman*, xliv, 10, pp. 42, 44, 1 fig., 1943.

An instrument has been constructed for the rapid determination of water repellancy in wood preservatives by measuring the degree of curl produced through the partial immersion of cross-section strips of treated and untreated ponderosa pine in water at 70° F. for stated periods. Using this procedure, tests may be completed in days instead of the weeks required to obtain comparable results by the National Door Association's approved technique.

FINDLAY (W. P. K.). **Wood tar as a preservative for timber.**—*Emp. For. J.*, xx, 2, pp. 151–153, 1943.

Agar tests carried out at the Forest Products Research Laboratory, [Princes Risborough], showed wood tars (from the Gold Coast, Nigeria, England, America) to be highly toxic to *Fomes annosus*, *Lentinus lepideus*, *Coniophora cerebella* [*C. puteana*], and *Polystictus versicolor*. In wood-block tests, in which small blocks of pine sapwood and of beech impregnated with the various tars were exposed for three months to attack by *L. lepideus*, *C. puteana*, *Poria vaporaria*, and *Polystictus versicolor* under controlled conditions, wood tars were found to vary considerably in their toxicity, some being equal to coal tar creosote, but others much less toxic. It is considered, however, that even the least toxic among them would be sufficiently

effective as a wood preservative provided that good penetration could be obtained with it. The disadvantages of these tars lie in their extreme viscosity and the high tar acid content responsible for their corrosive nature. It is suggested that in tropical countries where no local supply of coal tar creosote is available, wood tar could be usefully utilized for the preservation of timber. As the composition of wood tars is highly variable, depending largely on the kind of timbers from which they are derived and other factors, the problem of how to use them to the best advantage can only be solved locally.

CASS-SMITH (W. P.). **Black rot of Cabbage, Cauliflower, and related plants.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xx, 4, pp. 298–302, 4 figs., 1943.

Black rot (*Bacterium campestre*) [*Xanthomonas campestris*] occurs in Western Australia chiefly on cabbage and cauliflower, but it also attacks Brussels sprouts, broccoli, kohlrabi, turnip, swede, radish, flowering stock [*Matthiola incana*: *R.A.M.*, xxi, p. 291], and certain wild weeds, including mustard and wild radish. The disease is usually of small consequence in winter, but in warm, wet weather it may prove highly destructive, especially if it becomes established early in the growing season.

In March, April, and May, 1943, weather conditions favoured attack, and outbreaks occurred on cabbages in several areas, including Osborne Park, Spearwood, Balcatta, and Wanneroo. Serious losses were sustained, in some cases amounting to total crop failure. These outbreaks were largely attributed to the planting of contaminated seed, and there is no doubt that if growers had troubled to make use of simple control measures, the disastrous losses incurred could, to a great extent, have been prevented.

Unless the seed is known to be clean it should be submitted to hot-water treatment [ibid., xix, p. 250]. Seed-beds should be remote from the area where the transplants are to be set, and should be made on new soil or on land that has not grown cruciferous crops for several years. If necessary, the soil should be treated with formalin. Weed hosts should be eliminated from the vicinity. Care must be taken to avoid wetting the foliage in the seed-bed; planting should be carried out in moist soil, or furrow-irrigation should be adopted. Crucifers should be grown only once every two or three years in the same ground. Biting insects should be kept down, and all plant refuse burnt or buried in land that is not to be planted to crucifers for two or three years.

GREEN (D. E.) & ASHWORTH (D[OROTHY]). **Club root of Brassicas—control test II.**—*J.R. hort. Soc.*, lxix, 5, pp. 144–147, 1944.

In a further test at the Royal Horticultural Society's Gardens, Wisley, Surrey, in 1943 on the applicability of various chemicals to the control of club root (*Plasmodiophora brassicae*) [*R.A.M.*, xxii, p. 283] on spring-sown Primo, Winnigstadt, and Christmas Drumhead cabbages, Early White Stone turnips, and French Breakfast radishes, highly satisfactory results were again given by 4 per cent. calomel [mercurous chloride] dust raked into the soil at the rate of 1½ oz. per sq. yd., as well as by the proprietary substances A (containing calomel) and B, all of which appear to exert an effect persisting over more than one season. As temporary palliatives of the disease these preparations appear to be more efficient than lime or mercuric chloride, though for long-range treatments liming and proper cultural methods are probably superior. Mention may be made of the complete freedom from infection of the turnips in all three samplings (at 5, 9, and 12 weeks after sowing), as possibly indicative of high resistance in the test variety.

CARSNER (E.). **The Sugar Beet in Europe and America.**—*J. N.Y. bot. Gdn*, xlv, 530, pp. 25–30, 3 figs., 1944.

In connexion with a brief survey of the history of sugar beet cultivation in

Europe, where the foundation was laid by A. S. Marggraf, of the Prussian Royal Academy of Science in 1747, and the United States, where preliminary investigations were instituted in 1836, the writer cites some figures illustrative of the virulence of curly top. Since 1898, devastating epidemics of the disease at frequent intervals have swept through some of the factory districts of California, Utah, Colorado, Idaho, Oregon, and Washington. In 1934, for instance, 88 per cent. of the area under beets (18,635 out of 21,389 acres) in the Twin Falls region of Idaho was abandoned largely on this account, and the yield from the remaining fields averaged only 4·88 tons per acre, compared with 13·78 from 25,612 acres in 1933, a mild curly-top year. In 1941 the yields from the curly top-resistant varieties, U.S.1, U.S.33, U.S.12, U.S.22, and Improved U.S.22 [*R.A.M.*, xxiii, p. 159] amounted to 6·31, 8·40, 11·25, 14·32, and 16·61 tons per acre, respectively, whereas Old Type (European) produced no marketable beets.

REID (W. D.). **The resistance of Beans against Bean-wilt and anthracnose, and notes on occurrence of Bean mosaic.**—*N.Z. J. Sci. Tech.*, A, xxv, 3, pp. 125–128, 1943.

Of 34 bean varieties tested by the Plant Diseases Division at Palmerston North and Auckland from 1937 to 1942, two, Hamburger Market and Ousara, were free from wilt (*Pseudomonas medicaginis*) [*R.A.M.*, xiv, p. 140], six from anthracnose (*Colletotrichum lindemuthianum*), viz., Early White, Ne Plus Ultra, Northern Star, Idaho, W.S., and Wisconsin, and nine from mosaic, i.e., Blue Pod, Bush, Case Knife, Erecta, G.150, Refugee Idaho, Refugee Wisconsin, Unrivalled, and Zulu King. Of the ten varieties included for one or two seasons only, Epicure, Sydney Wonder, and White Dutch were immune from *P. medicaginis*, Brown Wonder, Epicure, Hodson's Long Pod, Kentucky Wonder, Startler Wax, Stringless Green Pod, Sydney Wonder, and White Dutch from *C. lindemuthianum*, and all except Kentucky Wonder (trace) and Stringless Green Pod (1 per cent.) from mosaic. In the six-year series of tests, the average infection by wilt, anthracnose, and mosaic ranged from a trace to 30, a trace to 55, and a trace to 45 per cent., respectively. Three varieties sustained very heavy damage from mosaic, namely, Dubbele or Doppelte, Perfect, and Zucker Perl.

REICHERT (I.), PALTI (J.), & KAPULER (B.). **Trials for the control of diseases of Vegetable Marrows. (First Report).**—*Bull. Rehovoth agric. Exp. Sta.* 33, 30+x pp., 4 figs., 1943. [Hebrew, with abbreviated English translation.]

The chief diseases affecting vegetable marrows in Palestine are powdery mildew (*Erysiphe cichoracearum*), blossom-end rot (*Pythium ultimum*), fruit rot (*Sclerotinia sclerotiorum*), leaf stalk rot, usually due to the last-named fungus, but sometimes caused by *S. minor*, and black mould (*Rhizopus nigricans*) [*R. stolonifer*].

In spraying and dusting experiments on autumn-grown vegetable marrows in the central coastal plain, powdery mildew was effectively controlled by yellow flowers of sulphur and Gaza sulphur (Superfine and Extra Fine grades), and by spraying with sulfinette 1½ per cent., while sulfocide ½ per cent. and the Standard grade of Gaza sulphur were weaker in action. The addition of lime to Gaza sulphur Extra Fine grade seriously impaired its effectiveness against mildew. Weekly applications of sulphur gave much better results than fortnightly ones, and the effects were even more striking when the applications were made at intervals of four to six days. These treatments increased productivity by 75 to 100 per cent. or more, and in two out of three tests considerably extended the duration of the picking period. Yellow sulphur partly controlled *Sclerotinia* leaf stalk rot, while Gaza sulphur and lime mixed, and sulfocide spray were less effective. The incidence of blossom-end rot was greatly reduced by sulphur treatment (especially by

yellow sulphur) in one experiment, though in a second test these and other sulphur treatments failed to control the disease.

In one test, copper treatments with bordinette $\frac{2}{3}$ per cent., perenox $\frac{1}{3}$ per cent., and Bordeaux mixture 1 per cent. reduced the incidence of powdery mildew effectively, but gave less control of leaf-stalk rot and blossom-end rot than the sulphur treatments. The copper treatments gave lower yields than the sulphur treatments, possibly because they had an adverse effect on the leaves.

Wastefully heavy rates of application were found necessary in the case of the pure Gaza sulphurs of the Standard and Extra Fine grades, as these emerge from the duster in streamlets instead of forming clouds of dust. The addition of lime weakened the fungicidal effect of the sulphur to such an extent that these grades cannot be recommended until suitable fillers are found. On the other hand, the Superfine grade of Gaza sulphur was even more economical than yellow sulphur, and appears to equal the latter in every way.

The material outlay involved in ten applications of sulphur dust at 10 kg. per 1,000 sq. m. per application and of sulfinette $1\frac{1}{2}$ per cent., 200 l. per 1,000 sq. m. per application, i.e., of 100 kg. sulphur and of 30 l. sulfinette, is about the same. As dusting requires only about half the amount of labour that would be employed in spraying, dusting is the cheaper method.

The results obtained in these experiments justify the assumption that treatment may increase the yield by 70 to 100 per cent. On a basis of the yields obtained in the tests, this additional yield represents an increase in the gross income from 1,000 sq. m. of about 10£P., while the total expense incurred will not exceed 4£P. per 1,000 sq. m.

MUJICA (F.). **La septoriosis del Apio en Chile.** [Celery septoriosis in Chile.]—*Bol. Sanid. veg., Santiago*, ii, 2, pp. 140–143, 1942.

Celery blight (*Septoria apii-graveolentis*) is stated to be responsible for immense annual losses to growers in Chile, where it is the most destructive disease of the crop. The mean dimensions of the conidia on three specimens of celery and one of *Apium nodiflorum* ranged from 34·6 to 42 by 1·8 to 2·4 μ. Of the three methods of seed disinfection variously recommended, viz., 30 minutes' immersion in mercuric chloride 1 in 1,000, the same period in hot water (48° to 49° C.), and 15 minutes in formalin 4 in 1,000, the last-named is the least injurious to the seed, though somewhat less effective than the others. Bordeaux mixture (1 per cent.) should be applied at 10- to 15-day intervals from the emergence of the seedlings until their transplantation to their final quarters.

KLIGMAN (A. M.). **Some cultural and genetic problems in the cultivation of the Mushroom, Agaricus campestris Fr.**—*Amer. J. Bot.*, xxx, 10, pp. 745–763, 7 figs., 1943.

The author proposes the trinomial *Agaricus campestris bisporus* for the cultivated mushroom to mark its physiological and morphological distinctness from the wild four-spored *A. campestris*. The tip cells of the growing mycelium were found to contain 7 to 25 nuclei, there being no diminution in number as the mycelium grows. The nuclei in tip cells divided independently, not simultaneously; they were distributed at random, and showed no disposition to pair. It is concluded that conjugate nuclear division does not occur in *A. campestris bisporus*. In the wild *A. campestris* fundamentally similar nuclear phenomena were observed. The cultivated mushroom is regarded as homothallic even though its nuclear behaviour is unlike that of other homothallic Hymenomycetes. Since monosporous mycelia produce perfectly normal sporophores, heterothallism is inadmissible. Monosporous isolates of the cultivated mushroom exhibited wide differences in rate of growth, cultural appearance, physiological activity, and productivity. From 20

to 30 per cent. of monosporous mycelia were sterile; such mycelia being usually atypical in mycelial characters. Multisporous cultures were never sterile: all hyphal tips cut off from a very young multisporous mycelium were found to be fertile.

In a small number of cases, sporophores were produced when sterile races were paired. Owing to the manner in which the mycelia interacted with each other, successful crosses were apparently not due to the pairing of uni-sexual strains, and no evidence was found to indicate the existence of such strains. An analysis of nuclear division in the tip cells indicated that sister nuclei are apparently not prohibited from lying in the same cell so that the two nuclei which fuse in the basidium are probably not of opposite sex. It is suggested that *A. campestris bisporus* as well as other homothallic Hymenomycetes might possibly be non-sexual.

Sectors were very commonly observed in mycelia of the white form of the cultivated mushroom, but never in the brown one. All those which had appeared were similar in cultural appearance and are termed the 'fluffy' as distinct from the normal 'appressed' type of mycelium. The fluffy type readily reverted to the normal. The appearance of sectors was not associated with observable changes in genetic constitution and hence these are not regarded as true mutants.

Mycelia derived from pieces of tissue were just as stable as those derived from spores. Cultures of *A. campestris bisporus* could apparently be indefinitely sub-cultured without 'running-out' or degenerating. Ageing of the mycelium does not, within limits, result in variation. Strains of the species are not fundamentally altered by the particular type of spawn substrate on which they are grown. Mutations affecting the morphology and colour of the sporophores are for the most part stable and can be propagated by monosporous, multisporous, and the tissue culture methods. Factors governing the colour of the sporophores appear to be particularly mutable. Random pairing of sterile mycelia of the brown and white forms of the cultivated mushroom resulted in the production of sporophores in a few instances but no evidence was obtained indicating that such sporophores were hybrids. When a mixture of spores of the brown and white forms were germinated, hybrids could not be detected among the sporophores produced by the mixed mycelium. It would appear that selection among monosporous mycelia offers the greatest opportunity for isolating new strains. Mycelia derived by the multisporous method or by the tissue culture technique do not usually exhibit variations from the parent.

Hadorn (C.). **Weitere vergleichende Versuche im Jahre 1943 über Kupfersparmöglichkeiten im Weinbau.** [Further comparative experiments in the year 1943 on copper-saving possibilities in viticulture.]—*Schweiz. Z. Obst- u. Weinb.*, liii, 6, pp. 100–128, 1 fig., 5 graphs, 1944.

Continuing his experiments at the Wädenswil (Zürich) Research Station in connexion with copper-saving treatments for the control of vine downy mildew (*Peronospora*) [*Plasmopara viticola*: *R.A.M.*, xxii, p. 341], the writer makes the following observations and recommendations. The quantities of copper allotted by the authorities for agricultural purposes in 1943 [ibid., xxi, p. 497] were experimentally shown at Lausanne [ibid., xxii, p. 91] and Wädenswil to be generally adequate. Trials at the latter Station of 39 fungicides revealed no further practical possibilities of economy in copper consumption, except in the case of copper oxychloride Rohner A, a product manufactured by Rohner A 9, Pratteln, exclusively from salvaged waste material which gave highly satisfactory results at a concentration of 0·75 per cent. It is estimated that every ton of the new copper oxychloride used spares 320 kg. metallic copper of the existing war reserve. The summer of 1943 was a dry one, and in rainy seasons the dosage may have to be

slightly increased. Rohner A has also proved its worth in the orchard and vegetable garden. However, pending a final decision as to the place of the new copper oxychloride in the spraying campaign, red copper Sandoz (0·3 or 0·5 per cent.) is the only 'economy' preparation to be unreservedly recommended.

Promise of interesting future developments was given by 1·5 per cent. Siegfried II A and II B combined copper salts containing only 8·4 per cent. metallic copper (AG. vorm. B. Siegfried, Zofingen), and the Fundal spray (Reb-Fundal) and dust (Staub-Fundal), copper-free preparations supplied by Schering AG., Berlin.

STANLEY (W. M.). **Chemical properties of viruses.**—*Rep. Smithson. Instn, 1942*, pp. 261–272, 6 pl., 1943.

This paper is reprinted from *Sci. Mon., N.Y.* [*R.A.M.*, xxi, p. 49].

STANLEY (W. M.). **Soviet studies on viruses.**—*Science*, N.S., xcix, 2564, pp. 136–138, 1944.

In this address to the Science Panel of the Congress of American-Soviet Friendship, New York, 1943, the author surveys the achievements of Russian science in the field of virus study, from Iwanowski's famous filtration experiment described by him in 1892 to the recent researches in plant and medical virology by Rischkov [Ryjkoff], Goldin, Soukhov [Soukhoff], Vovk, Gromyko, and others. The author regards Iwanowski as having the same relationship to the study of viruses as Pasteur and Koch are commonly regarded as having to that of bacteriology.

Fifty-fifth Annual Report of Purdue University Agricultural Experiment Station, Lafayette, Indiana, for the year ending June 30, 1942.—108 pp., 10 figs., 1 graph, 1942.

The following are among the items of phytopathological interest occurring in this report [cf. *R.A.M.*, xix, p. 7]. C. L. BURKHOLDER, T. E. HEINTON, and S. A. ANDERSON state that at the Moses Fell Annex Farm orchard at Bedford, Indiana, where over 167,000 gals. spray were applied in 1941, a stationary spray-pumping plant controlled diseases and insects at a smaller outlay than a portable apparatus. The average cost per 100 gals. amounted to 44 cents in 1941, and 42 cents in 1935–39, while the lowest yearly cost of portable spraying amounted to 70 cents per 100 gals. In a commercial orchard near Vincennes, Indiana, where a stationary plant capable of servicing 12 to 14 gunmen and over 1,000,000 gals. material per year was used, the average cost per 100 gals. for the ten-year period 1931–41 was 25·7 cents, while in 1941 the figure was 19 cents, which is lower than any spray cost figures published.

P. R. ELLIKER, W. H. BROWN, and B. E. HORRALL state that stirring mould-contaminated cream twice daily retards mould growth but encourages that of yeasts. Addition of fresh cream by layering it over the stored cream results in less growth than where cream is poured into the container without layering. Mould-contaminated cream results in mouldy butter, at least 50 per cent. of the mould content of the cream being carried over in the churning. Stirring retards mould growth because the moulds are removed from the top surface of the cream during the process and put down in the lower layers, where there is less oxygen. *Oospora lactis*, the mould organism most often found in cream [ibid., xxi, p. 16], actively utilizes the lactic acid in milk when the nitrogenous and other requirements of the fungus are met. Sour cream thus provides an excellent source of energy in the form of lactic acid for these moulds.

G. H. CUTLER states that the new soft winter wheat variety Fairfield, developed in Indiana, is superior to all the common soft winter wheat varieties at present grown in the State. It combines the good milling and baking qualities and the loose smut [*Ustilago tritici*] and mosaic resistance of Fulhio with the high yield,

high resistance to winter-killing, and the excellent suitability for combine-harvesting of Purkof.

Inoculation studies by A. J. ULLSTRUP showed that a spore suspension of *Diplodia* [*zeae*] can easily be applied to the ears of dent maize by means of a pressure sprayer. In this way, a great deal of material can be tested with a minimum of labour. The best time for applying the inoculum appears to be between the full-silk and the roasting-ear stages. The ears become more resistant as they approach maturity.

Preliminary results by S. O. THOMAS, J. A. MCCLINTOCK, and C. L. PORTER in work on the control of rose virus diseases showed that the critical temperature for roses is 52° C. As much as 85 per cent. of the material submitted to this temperature for periods ranging up to five minutes survived. Susceptible host plants inoculated with diseased material which was treated at 52° failed to show virus symptoms.

Five of eight fungicides tested by R. C. BAINES, N. K. ELLIS, and L. J. SWIFT effectively controlled anthracnose [*Sphaceloma menthae*: ibid., xvii, p. 485] of row peppermint [*Mentha* spp]. The treatments did not affect the chemical or physical properties of the oil obtained from the treated plants.

Tests by R. C. BAINES indicated that dinitro-cresol [elgetol] eradicant spray materials applied to fallen leaves are of only limited value against apple scab [*Venturia inaequalis*] in Indiana.

Working with oats, lucerne, and tobacco, H. E. JONES and J. D. SCARSETH found that a high calcium content in the soil tends to decrease boron availability [ibid., xxi, p. 43; xxiii, p. 277]. Since the calcium content of the plant is a direct function of that in the soil, the relationship between calcium and boron [in the plant] expressed as a ratio should indicate whether the amount of boron in the soil is deficient, optimum, or toxic. It was ascertained that oats grown on an acid soil to which borax was added at the rate of 25 lb. per acre developed toxicity symptoms, though lucerne and tobacco withstood 50 and 100 lb. per acre, respectively, on limed soils. A range of 20 to 180 p.p.m. boron was found in tobacco, 25 to 180 in lucerne, and 15 to over 400 in oats.

MARTIN (J. P.). **Pathology.**—*Rep. Hawaii Sug. Exp. Sta., 1942–3* (ex *Printed Reps. Hawaii Sug. Pl. Ass., 1943*), pp. 19–28, 1944.

In this report [*R.A.M.*, xxii, p. 343] it is stated that according to information received from A. F. Bell the Hawaiian sugar-cane varieties 28–4291, 31–2484, and 32–8560 are, under Australian conditions, resistant to downy mildew [*Sclerospora sacchari*: ibid., xxii, pp. 149, 276], while 31–1389 is highly susceptible; 28–4291, 31–1389, 31–2484, 31–2806, 32–1063, and 32–8560 are resistant to gumming disease [*Xanthomonas vasculorum*: loc. cit.], while 32–3575 is susceptible; and 28–4291, 31–2484, 31–2806, and 32–8560 are highly susceptible to Fiji disease [loc. cit.], while 31–1389 is moderately so.

C. W. CARPENTER states that brown stripe (*Cochliobolus stenospilus*) [ibid., xxi, p. 349] is still of major importance in localized areas, though incidence has been much lower during the past two years. Chlorotic streak [ibid., xxii, p. 344] is much more severe in poorly drained areas and regions of high rainfall than elsewhere. The best control measures are the selection of healthy planting material and the hot-water treatment of diseased or doubtful planting material. Field losses from eye spot [*Helminthosporium sacchari*: loc. cit.] were the lowest for many years, largely owing to the wide use of resistant varieties. Leaf scald [*X. albilineans*] was recorded on 32–8560 for the first time, but the evidence still indicates that this variety is highly resistant. In the fields, mosaic was of minor importance, the planting of resistant varieties having reduced the disease to a minimum. When Lahaina, H.109, and 32–8560 sugar-cane seedlings were grown in pots given 60 gm. sodium nitrate (equivalent to about 900 lb. nitrogen per acre), *Pythium* root rot [*P. graminicola*] became very severe on Lahaina, though in the control pot not

given the fertilizer treatment none was present. The growth of H.109 was better in the fertilized than in the untreated soil, though a moderate amount of root rot was present. In 32–8560 root rot was not identified, but growth appeared depressed in the treated soil.

C. W. CARPENTER states that tomato tip blight [ibid., xxii, p. 502] is very probably responsible for losses in Hawaii previously attributed to spotted wilt. Under field conditions, both young and mature tomato plants became severely defoliated as a result of infection by grey leaf spot (*Stemphylium solani*) [ibid., xxii, pp. 54, 81, 116]. Young plants of the Bounty, Pritchard, and Marglobe varieties grown under moist conditions were sprayed with a suspension of the fungus in water; the first symptoms of the disease became apparent at the end of the second day. Bounty was most severely affected, and Marglobe was slightly more resistant than Pritchard.

Gall-like blisters ('oedema') were observed on cabbage seedlings and plants. The abnormality is attributed to want of balance between water absorption and transpiration. The excessive pressure produced in certain thin-walled leaf cells results in a localized overgrowth and a bulging of the leaf surface. These bulges usually rupture and become dry and corky.

Diseases of truck crops studied included *Cercospora beticola* on beet, *C. apii* var. *carotae* on carrot, *Septoria consimilis* on lettuce [? *Lactuca scariola*], *Phytomonas viridilivida* on lettuce, *Mycosphaerella berkeleyii* [*C. personata*] on groundnut, *Piricularia oryzae* on rice, and *Pseudomonas glycines* on soy-bean.

Verslagen Proefstations. [Experiment Station Reports.]—*Versl. Landb. Synd., Batavia, 1940*, pp. 154–282, 1941.

These Dutch East Indian experiment station reports contain, *inter alia*, the following items of phytopathological interest. *Hevea* rubber plants in sand cultures deprived of nitrogen, phosphorus, or sulphur were drastically reduced both in height and girth, a shortage of these elements being manifested earlier than that of potassium, calcium, or magnesium. Nitrogen deficiency is expressed by a uniform chlorosis of the leaves, which are of a somewhat stiff growth habit, whereas in the case of lack of sulphur, the yellow coloration is more mottled. An abnormally dark green, later orange-red tinge is characteristic of an insufficiency of phosphorus. Interveinal chlorosis is the typical feature of magnesium starvation, while inadequate supplies of potassium and calcium result in marginal spotting of the leaves, accompanied in the case of the former element by desiccation.

Generally speaking, the white root-rot fungus (*Fomes lignosus*) predominates in young rubber plantations (up to the age of six or seven years) in West Java [cf. *R.A.M.*, xxi, p. 323], and the agent of red root rot (*Ganoderma pseudoferreum*) in older ones, but in 1940 the former organism was shown to be responsible for large gaps even in long-established gardens. In such cases, a year or more before the undertaking of clearing operations, decayed wood and root debris should be removed and the immediately surrounding trees eradicated, thereby affording an opportunity for the sanitation of the focus of infection. The root-collars of the neighbouring healthy trees should be exposed to prevent the spread of both pathogens [ibid., xvi, p. 634]. In young plantings over a wide clearing the extension of *F. lignosus* was assisted by the presence of *Tephrosia* between the rows of rubber [loc. cit.]. The first indication of white root rot on seedlings in the Lampongs was frequently observed in grooves on the stems. Under favourable conditions the trees may completely overcome the effects of the disease. At the Besoeki (Java) Experiment Station, *F. lignosus* severely attacked rubber in a cleared area, and was also found on *Desmodium gyroides*, *Leucaena glauca*, and coffee.

Mildew [*Oidium heveae*] occurred in an unusual form in the inflorescences and on the young leaves of rubber, being accompanied in the former organs by the larvae

of the ladybird, *Thea cincta*, which feeds on the fungus. The violent outbreaks of the disease in a number of plantations may have been connected with the abnormal drought.

On an estate where brown bast was very troublesome, the incidence of the disease was reduced, without impairing latex production, by the adoption of the 'change-over' tapping system (based on modifications in the relative positions of the cuts), as officially practised and recommended by the experiment station authorities [ibid., i, p. 265].

Effective control of stripe canker [*Phytophthora palmivora*] in the Lampongs was obtained by weekly applications of socony product 2295 A plus 5 per cent. carbolineum plantarium [ibid., xviii, p. 579; xxi, p. 323], which was also useful in the protection of the wounds inflicted in the excision of bark infected by pink disease [*Corticium salmonicolor*].

In old rubber plantations on a mountain estate under the supervision of the Central and East Java Experiment Station, severe damage was caused by black root rot (*Rosellinia bunodes*) on the *Centrosema* [? *pubescens*] cover crop, which died off over wide areas during the dry spell. From another estate, where similar trouble had been experienced in connexion with *Xylaria thwaitesii*, favourable reports were received concerning the replacement of *C.* (?) *pubescens* by Lima bean (*Phaseolus lunatus*). The same measure was successfully adopted in the case under review, the Lima bean crop flourishing in spite of the presence of brown, sunken spots on the stem bases, which in laboratory inoculation tests bore a profusion of perithecia and coremia.

Investigations on the possibilities of combating red root rot of tea (*G. pseudoferreum*) on a Buitenzorg estate [ibid., xviii, p. 579] led to the following conclusions. *Albizzia* [*falcata*] is of great importance in the transmission of infection. Dead and dying bushes should be eradicated and removed, together with any other infective material, as rapidly and completely as possible. The so-called 'isolation trenches' do not entirely arrest the spread of the pathogen. Gaps in the stand arising through the action of the red root-rot fungus should be deeply excavated and all woody remnants cleared away during the interval before replanting.

On one tea estate, a high proportion of the bushes were found to have been killed, not by *G. pseudoferreum*, but by *Ustulina* [*zonata*], which predominated, together with *Diplodia* [*Botryodiplodia theobromae*: loc. cit.], particularly among isolated cases in the midst of healthy bushes. *Poria hypolateritia* was prevalent on some plantations in southern Sumatra. Following the prolonged rains in the early part of the season, *Cercosporella theae* developed in certain gardens. This fungus consistently originates on *Acacia decurrens*, and after completely defoliating it, passes on to tea.

Many complaints were received from Sumatra concerning the damage inflicted on *Cinchona ledgeriana* [*C. calisaya* var. *ledgeriana*] by stripe canker [*Phytophthora palmivora*], investigations on which showed that new seed-beds were commonly laid down on the site of those just cleared of the same crop. This failure to practise crop rotation was likewise reflected in the mature stands. An effective method of control was found to consist in the excision of the diseased tissue right down to the wood and the application to the wound (which should taper to a point to assist in healing over) of socony grease plus 5 per cent. carbolineum.

Coffee branches infected by top die-back in Central and East Java [ibid., xix, p. 341] yielded the parasitic *Colletotrichum coffeanum* [*Glomerella cingulata*] in abundance, the organism ordinarily associated with the disease [*Rhizoctonia*] being only sporadic. Drastic pruning proved superior to more conservative methods in the control of top die-back. Pliofilm [ibid., xxi, p. 331] effectively protected inoculation wounds on coffee plants from desiccation, cellophane being useless for the purpose.

A species of *Corticium*, distinct from *C. gardeniae* or any other member of the genus hitherto found on coffee, occurred on Java coffee hybrids at the Besoeki Experiment Station, one phase being represented by a very delicate, cobweb-like mycelium overrunning the under sides of the leaves and the berries, which subsequently produces a white, powdery layer of typical fructifications, and another by dark brown, necrotic spots, permeated by a characteristic *Rhizoctonia* mycelium extending over the green areas and giving rise to pseudosclerotia [ibid., xii, p. 760]. The infected leaves finally die and turn brown, but being firmly joined to the neighbouring healthy ones by the above-mentioned mycelium, they mostly remain hanging on the bushes. Cultures from the *C.* stage, the pseudosclerotia, and the brown spots without fructifications all yielded a typical *R.* mycelium, accompanied in some isolations by pseudosclerotia.

HALPERIN (L.) & SPAINI (LYDIA S.). **Tres bacteriosis existentes en la Argentina.** [Three bacterioses existing in Argentina.]—*Rev. argent. Agron.*, vi, 4, pp. 261–275, 2 pl., 1939. [English summary. Received June, 1944.]

Descriptions are given of the symptoms and etiological agents of three bacterial diseases occurring in Argentina, viz., soft rot of cabbage and chilli (*Erwinia carotovora*), black rot of cabbage (*Phytomonas* [*Xanthomonas*] *campestris*), and bacterial spot of tomato (*P.* [*X.*] *vesicatoria*), together with notes on their host ranges, geographical distribution, mode of dissemination, economic importance, and control. *E. carotovora* has been observed on cabbage in the provinces of Buenos Aires, Santa Fe, Entre Rios, and Salta, and on chilli in Salta and Jujuy, *X. campestris* in Buenos Aires, Santa Fe, and Entre Rios, and *X. vesicatoria* in Buenos Aires. *E. carotovora* is responsible for heavy damage to its hosts, causing the total failure of the chilli crop, whereas *X. campestris* is chiefly important as paving the way for the infection of cabbage by the soft-rot organism.

CHEREWICK (W. J.). **Studies on the biology of Erysiphe graminis DC.**—*Canad. J. Res.*, Sect. C, xxii, 2, pp. 52–86, 1 pl., 1944.

Erysiphe graminis is reported to occur in all parts of Canada [*R.A.M.*, xxii, p. 155], even as far north as 65 miles north of the Arctic circle, but to be most prevalent in British Columbia and the five eastern provinces. In the Prairie Provinces, where epidemics are rare, infection up to 85 per cent. has been observed. So far, *E. graminis* was found on all the common cereals in Canada and also on *Agropyron* spp., *Beckmannia syzigachne*, *Bromus* spp., *Dactylis glomerata*, *Hordeum jubatum*, *Phleum pratense*, and *Poa* spp.

Experimental evidence obtained in Manitoba during 1941 and 1942 indicates that *E. graminis* most usually overwinters in mycelial mats on dead straw or as mycelial infections on volunteer or winter grain plants and on perennial grasses; it only occasionally overwinters to some extent in the perithecial stage [cf. ibid., xxii, p. 165].

Three new races of *E. g. hordei*, namely, 8, 9, and 10, were isolated in 1941, bringing the total of races found in Canada to seven. For the differentiation of the new races it was necessary to add Chevron to the five test varieties of barley commonly used. A number of collections of wheat mildew from British Columbia, Manitoba, and Ontario yielded only race 1 of *E. g. tritici*. *E. g. avenae* on oats is known to occur in eastern Canada and British Columbia. Studies with the various races of *E. g. hordei* from barley showed them to be stable under different environmental conditions; they are considered to be distinct biologic entities comparable to physiologic races of the cereal rusts. Results obtained from hundreds of cross-inoculations furnished no evidence that any variety of *E. graminis*, except possibly *E. g. agropyri*, can produce infection in immune varieties of its own host, or on the host of another variety, even if such hosts are injured. Germination of the conidia

of *E. graminis*, and penetration up to the papilla stage, were found to occur on the naturally immune hosts as on the susceptible ones. Two distinct types of host resistance were observed: in some hosts it manifests itself by the death of the infected cells, and in others by the distortion of the haustoria. Of the 29 single-spore cultures of *E. g. hordei* and 4 of *E. g. tritici* grown in isolated compartments or booths, 26 and 1, respectively, produced perithecia within from four to six weeks. On several occasions where mono-ascospore cultures were made from these perithecia, a pure race of the respective parent culture was obtained in each case. It is concluded that at least certain varieties and races of *E. graminis* are homothallic. On the other hand, conidial collections of barley mildew made during two seasons from experimental field plots yielded only races 4 and 6, while collections of perithecia from the same plots yielded races 4, 6, 9, and 10, indicating that recombination and segregation of factors may occur in perithecia developed in the field.

Field and greenhouse studies on the effect of environment upon the powdery mildew indicated that temperature is an important factor in mildew epiphytotics, while light has only an indirect effect, acting through the host plant, poor light rendering the nutritional conditions unfavourable to the organism. The conidia were shown incapable of surviving storage for any length of time at temperatures above the freezing point; they either germinated or died. Germination occurred readily at from 0° to 35° with an optimum at 10° C. Both the infection and the development of the disease was best at from 15° to 20°, alternating temperatures being most favourable to both the spread of mildew and the development of perithecia. Alternate drying and wetting of perithecia were necessary to induce ascospore formation, but other stages were favoured by relatively dry conditions. Conidia germinated quite well even at zero humidity [ibid., xvi, p. 104]. The percentage of infection was consistently reduced by sprinkling infected seedlings with water [ibid., xviii, p. 465], but the exact reason for this was not determined. In the light of the results obtained, it is concluded that the main function of perithecia in this species is to carry the organism over hot periods in the late summer rather than to serve as the overwintering stage. The addition to the soil of certain fertilizers and chemicals commonly claimed to increase host resistance to powdery mildew failed to increase the resistance of susceptible seedlings of wheat and barley.

Vitoria (E. R.). **El desarrollo de Fusarium avenaceum influido por el filtrado del substrato de Penicillium sp.** [The development of *Fusarium avenaceum* influenced by the filtrate of the substratum of *Penicillium* sp.]—*Rev. argent. Agron.*, vi, 4, pp. 309–314, 2 figs., 1939. [Received June, 1944.]

Fusarium avenaceum (strain 249 of the Argentine Ministry of Agriculture's collection from an unspecified host) [*R.A.M.*, xx, p. 235; xxi, p. 12], which made no growth in the author's experiments on a plain Coons's liquid medium, developed abundantly on the same substratum with the addition of filtrates of two undetermined species of *Penicillium* and *P. gladioli*, also grown on Coons's medium. The growth substances contained in the filtrates appear to act quantitatively at first, but this relationship is not maintained after 48 hours, the amounts of mycelium of *F. avenaceum* produced in a fortnight by cultures enriched with 50, 1, and $\frac{1}{4}$ c.c. of the *Penicillium* liquid being 150, 22, and 44 mg., respectively. The stimulatory effect of the *P.* filtrates evidently resides in the growth substances themselves, since no indication of the secretion of thermolabile enzymes was forthcoming.

Atkins (J. M.) & Quinby (R.). **'Comanche', disease-resistant Wheat, for planters of the plains.**—*Sth. Seedsm.*, vi, 11, pp. 17, 44, 1943.

A new hard red winter wheat variety, Comanche, resistant to the four known physiologic races of bunt [*Tilletia caries* and *T. foetida*] and leaf [brown] rust

[*Puccinia triticina*], and frequently escaping severe damage from stem rust [*P. graminis*] through its early maturity [*R.A.M.*, xxiii, p. 295], is now available for general distribution and is specially recommended for the Rolling Plains area of north-western Texas. In a four-year test conducted by the United States Department of Agriculture at experiment stations in the Middle West, the stands of Comanche raised from inoculated seed-grain averaged only 8·9 per cent. bunt compared with 38·9 and 65·1 for Kharkof and Chiefkan, respectively. Other desirable characters of Comanche include reasonably heavy cropping and excellent milling and baking qualities.

DALLMAN (A. A.). **Puccinia secalina Grove.**—*Northw. Nat.*, xviii, 3, p. 223, 1943.

In October, 1943, the aecidial stage of *Puccinia secalina* [*P. dispersa*], stated by W. B. Grove in The British Rust Fungi (Uredinales), 1913, to be very rare in Britain, was detected on the leaves of a few plants of *Lycopsis arvensis* scattered over a turnip and potato field near Doncaster (Yorks.).

ULLSTRUP (A. J.). **Further studies on a species of Helminthosporium parasitizing Corn.**—*Phytopathology*, xxxiv, 2, pp. 214–222, 2 figs., 1 graph, 1944.

Further studies are described on the fungus attacking maize throughout the Central Corn Belt of the United States, which was originally referred to *Helminthosporium maydis*, the imperfect stage of *Cochliobolus heterostrophus* [*R.A.M.*, xxi, p. 71], but has now been shown to be morphologically distinct and is designated *H. carbonum* n.sp., the specific epithet relating to the charred appearance of the diseased ears.

The straight or slightly curved, dark olivaceous-brown, 2- to 12- (mean 7) septate conidia measure 25 to 100 by 7 to 18 (62·6 by 13·2)μ, and are borne singly or in groups on conidiophores of the same colour, germination being effected by means of two polar germ-tubes. The species is divided into two morphologically indistinguishable races. Race I induces small, pale green or yellowish lesions in early infections, later developing into zonate spots, 5 by 20 mm., with dry, light brown centres and light to purplish-brown margins. The ears are infected through the tips, shanks, or directly through the husks. Race II caused the formation of lesions similar to those of Race I in the early stages, but when fully developed they are elongated, irregular, up to 3 by 20 mm., chocolate-brown in colour, and with less distinct zonation. The ears were more frequently attacked by this race than the leaves. During the five years of the author's observations on *H. carbonum*, no indication of an ascigerous stage has been detected.

KULKARNI (G. S.). **Baluchistan sulphur for Jowar smut.**—*Curr. Sci.*, xiii, 2, p. 48, 1944.

India being at present cut off from her normal foreign sources of sulphur supply, experiments have been conducted against *Sphacelotheca sorghi* on sorghum at the Gwalior Government Central Farm with the product of the Baluchistan mines, where the element occurs in a crude form in lumps, necessitating fine grinding before use as a seed dressing. The inoculated seed-grain (8 lb.) was divided into three equal lots, of which one was dusted with Baluchistan sulphur passed through a sieve of just over 100-mesh fineness, another with 200-mesh commercial flowers of sulphur, both at the rate of ½ oz. per 8 lb., and the third left untreated as a control. The incidence of smutted heads in the three lots was none out of 7,489, none out of 8,462, and 2,709 out of 8,703, respectively. It is apparent from these data that the home-produced sulphur, the purity of which is only about 56 per cent., is equally effective for the object in view with the 99 per cent. pure commercial brand.

Padwick (G. W.) & Mundkur (B. B.). **Kulkarni's note on Baluchistan sulphur.**—*Curr. Sci.*, xiii, 2, pp. 48–49, 1944.

In 1942–3, a comparative test was carried out with Baluchistan sulphur [see preceding abstract] and other fungicidal dusts against barley covered smut [*Ustilago hordei*] at a dosage of 1: 250 by weight in replicated plots at (A) Delhi and (B) Karnal, with the following results: (A) pure sulphur, formalin dust (6 per cent. formalin on charcoal dust), agrosan G, and Baluchistan sulphur 0·08, 0·00, 0·01, and 0·05 per cent. infection, respectively, with 1·20 in the untreated controls, and (B), 0·10, 0·04, 0·08, 0·08, and 1·44, respectively. In 1943, two different lots of sorghum seed, one (A) from Rohtak and the other (B) from Karnal, naturally infected by grain smut [*Sphacelotheca sorghi*], were dusted with Baluchistan sulphur, hand-picked before grinding and so raised to a purity of 75 per cent., and sown over areas of (A) 1 and (B) 11·5 acres, respectively, the untreated lots from the two districts covering 11 and 0·5 acres, respectively. No smut developed in either of the plots from the dusted seed, whereas the incidence in the (A) and (B) controls amounted to 9·8 and 2·1 per cent., respectively.

Frezzi (M. J.). **Podredumbre morena de los frutos cítricos y parásitos que la producen en Corrientes, Argentina.** [Brown rot of Citrus fruits and the parasites that produce it in Corrientes, Argentina.]—*Rev. argent. Agron.*, ix, 3, pp. 216–220, 2 pl., 1942. [Received June, 1944.]

The writer's observations on the brown rot of citrus fruits caused by *Phytophthora parasitica*, *P. citrophthora*, and *P. boehmeriae* in Argentina have already been noticed from other sources [*R.A.M.*, xxi, p. 195 and below, p. 296]. The fourth agent of the disease, *P. megasperma* [ibid., xi, p. 303; xiii, p. 25], was isolated in July, 1941, from sweet oranges in Bella Vista. The two first-named species are the most widely distributed and responsible for the heaviest losses. Under natural conditions the symptoms produced by the four fungi are indistinguishable.

Reid (W. D.). **Resistance of Poorman's Orange against Citrus canker (Pseudomonas citri Hasse).**—*N.Z. J. Sci. Tech.*, A, xxv, 4, pp. 170–173, 1943.

Previous investigations having revealed a very slight incidence of citrus canker (*Pseudomonas* [*Xanthomonas*] *citri*) in Poorman's Orange (New Zealand grapefruit) [pomelo × sour orange] in comparison with other species [*R.A.M.*, xvii, p. 813], further studies were undertaken to determine the basis of this apparent resistance to the disease. The results of field and greenhouse inoculation experiments showed Poorman's Orange to be approximately equal in susceptibility to canker with rough lemon and sweet orange, and its frequent escape from infection in the orchard is thought to rest rather on the temporary factors of age and condition of the foliage at the moment of infection than on any inherent resistance. In a citrus canker eradication campaign, therefore, it should be treated in the same way as species of recognized susceptibility.

Fawcett (H. S.), Perry (J. C.), & Johnston (J. C.). **The stubborn disease of Citrus.**—*Calif. Citrogr.*, xxix, 6, pp. 146–147, 3 figs., 1944.

A non-productive type of Washington Navel orange tree referred to as 'stubborn' was observed in the groves of the East Highlands Orange Company, California, after a performance record lasting from 1915 to 1917. When top-worked in 1921 with carefully selected buds such trees subsequently developed the same characteristics as the original trees. Navel oranges similarly affected were observed in the Redlands area in 1938. About 1924, Perry noted a condition of Navel orange fruits, then called 'pink nose', at East Highlands. This later became known as 'acorn' fruit [see next abstract], and was observed in the Redlands district and

elsewhere, especially in Eastern Los Angeles and San Bernardino counties. An abnormal type of branch growth was noted on the trees producing the 'acorn' fruit, which was suspected to be identical with grapefruit 'crazy top'. More recently, Navel orange trees of the 'stubborn' type with acorn-shaped fruit have been noted in eastern Los Angeles as far west as Azusa. In Arizona, workers had for long observed a similar condition known as 'pink nose' on grapefruit, accompanied by a growth condition called 'crazy top'. The 'stubborn' disease and the 'acorn' fruit in Navel oranges were thought to be distinct, until Johnston drew attention to the similarity of the foliage and branch characteristics of all these sets of trees. It was then observed that the 'acorn' fruit and the other symptoms were present on almost all the affected trees in all the localities referred to.

In 1938, five trees each were grown at the Citrus Experiment Station from buds of three 'stubborn' trees in the Redlands area. One progeny tree died, and the remaining 14 now (1944) show leaf and branch symptoms. One half of these were top-worked with healthy buds in 1942, and the shoots from these healthy buds now appear to be affected. In one case, the healthy buds were placed on a shoot from the originally healthy stock, on which a diseased Navel bud had grown, and these healthy Navel buds as they grew out also became affected. Other trees budded in 1938 at the Experiment Station from 'stubborn' trees in East Highlands are now small and dwarfed, with 'stubborn' symptoms. Pending further studies, it is pointed out that the disease of grapefruit in Arizona known as 'crazy top', with its accompanying 'acorn' fruit and 'blue albedo' may be the same disease.

The most constant characteristic of 'stubborn' disease is an abnormal type of foliage and branches. This generally becomes most evident in winter, when affected Navel trees tend to show an untimely autumn growth of small branches and leaves. More of the leaves appear to be broader and shorter and to bend upward more on each side of the midrib than is the case with healthy trees. The leaves generally become chlorotic and, at first, more numerous in a given space, owing to greater branching of the twigs; in severe cases, the leaves tend to fall more than on healthy trees. The growth of multiple buds and shorter internodes causes the trees to present a brush-like appearance. Fruiting gradually declines. The fruits are fewer, more irregular in size and shape, paler, and show more 'off-bloom' individuals than are found on healthy trees. Late in the season, some fruits usually show the 'acorn' shape. On these, the rind appears of normal texture, but uneven near the stem end, becoming abruptly thinner and smoother on the surface, till it is quite thin near the stylar end. This thinning may reach part or all of the stem end. In Navel fruits, the stylar or navel end assumes a pinkish colour.

In grapefruits, a blue colour is present in the albedo of the thin part of the rind; in severe cases, the pulp of the stylar end has a sour, disagreeable odour.

In view of the probable virus nature of the disease, care should be taken to avoid budding nursery trees with buds from affected trees.

HAAS (A. R. C.), KLOTZ (L. J.), & JOHNSTON (J. C.). **Acorn disease in Oranges.**—*Calif. Citrogr.*, xxix, 6, pp. 148, 168–169, 3 figs., 1944.

In 1937, a grower in West Ontario [California], observed a branch of one of his Navel orange trees bearing acorn-shaped fruits of poor quality [see preceding abstract]. By 1940, such branches and fruits had become numerous, and production declined alarmingly. An orchard near Redlands also showed the condition, to a striking extent.

The disease became more readily discernible with increasing maturity of the trees. In some years the shape of the diseased fruits resembled very much that of an acorn, the stem portion of the peel resembling the cap, while in others the symptom was much less evident. The blossom-end of the peel is of a lighter colour ('pink nose') than normal and very thin; it is subject to attack by fungi. Certain

branches tend to produce diseased fruits and others healthy, though eventually all branches bear only abnormal fruit. 'Acorn' fruits are of such poor quality that they have to be culled.

Affected trees show a marked loss of mature leaves, imparting to the uppermost portion of the tree an open appearance known as 'crazy top'. In the lower parts there is an excessive vegetative growth: mature leaves fall and multiple buds give rise to numerous short shoots with new leaves, the dense growth of young foliage persisting throughout the winter.

The juice of 'acorn' fruits had a more acid taste in the blossom half than in the stem half, which is the opposite to normal, while the amount of reducing sugars was greater in juice from the stem half than from the blossom half, which is again the reverse of normal. The juice in the tip halves of fruits from healthy trees contained more total sugars than that in the stem halves, whereas in 'acorn' fruit the juice from the tip halves contained far less than the stem halves. There was a marked reduction of dry matter in the peel of the tip halves of 'acorn' fruits. The appearance of 'acorn' fruits in diseased Navel orange trees budded over to Valencia orange (both the Navel sprouts and the Valencia top bearing 'acorn' fruits) suggests that the disease is due to a virus.

Blackford (F. W.). **Five minor fungous and virus diseases of Citrus.**—*Qd agric. J.*, lviii, 2, pp. 95–99, 3 figs., 1944.

In continuation of his earlier papers on citrus diseases in Queensland [*R.A.M.*, xxiii, p. 260], the author gives a brief account of five less important troubles, viz., collar rot due to various fungi [? chiefly *Phytophthora parasitica*: ibid., xvi, p. 451; xxii, p. 133], root rot due to *Armillaria* [*mellea*: ibid., xix, p. 24; xxi, p. 440], that due to *Ganoderma* sp. [ibid., xv, p. 280], psorosis [ibid., xxiii, p. 61], and pink disease [*Corticium salmonicolor*: ibid., xviii, p. 794; xx, p. 290].

A noteworthy feature of *Ganoderma* attack is the adherence of the soil to the bark of the roots, forming a sheath round them. The bark itself readily separates from the wood and the creamy, woolly growth of the mycelium is found beneath. The fungus has been found on old stumps of bloodwood [*Eucalyptus* spp.] and ironbark [*Eucalyptus* spp.] and from these is able to attack citrus growing near by. For the control of *A. mellea* and *Ganoderma* the author recommends thoroughly clearing the land and if possible sowing a green manure or other annual crop before planting. Treatment of the soil with carbon disulphide might also be tried.

Frezzi (M. J.). **Phytophthora boehmeriae, causante de la podredumbre morena de los frutos cítricos, en la Republica Argentina.** [*Phytophthora boehmeriae*, the agent of brown rot of Citrus fruits in the Argentine Republic.]—*Rev. argent. Agron.*, viii, 3, pp. 200–205, 3 figs., 1941. [Received June, 1944.]

Full details are given of the morphological characters of *Phytophthora boehmeriae*, the agent of a brown rot of sweet oranges new to Argentina, reference to which has already been made [*R.A.M.*, xxi, p. 185]. The dense, white, velvety, persistent mycelium developing on orange and lemon fruits inoculated with particles of 1 per cent. potato dextrose agar cultures of the fungus is readily distinguishable from the relatively sparse delicate growth of *P. parasitica* and *P. citrophthora* on the same hosts [see above, p. 294].

Progress Reports from Experiment Stations, season 1942–43.—181 pp., 6 graphs, 1 diag., London, Empire Cotton Growing Corporation, 1944.

These reports [cf. *R.A.M.*, xxii, p. 304] contain, *inter alia*, the following items of interest. At Bremersdorp, Swaziland, maize streak [ibid., xxi, p. 241], attacks of which have hitherto been slight, and confined to late-planted crops, showed a dis-

quieting increase. Highly resistant strains obtained from Barberton are to be bulked for late plantings and winter-grown crops.

Cotton angular leaf spot [*Xanthomonas malvacearum*] was scarcely noticeable in Southern Rhodesia.

The chief problems in the northern Gezira area of the Anglo-Egyptian Sudan were the leaf curl jassid [unspecified] and, to a less extent, blackarm. As the climate here is drier than it is to the south, blackarm [*X. malvacearum*] is less likely to be spread by wind-blown rain. The control measures in use have reduced the risk of crop failure, but in future more attention will be paid to Domains Sakel and the production from it of high quality selections resistant to jassid, blackarm, and leaf curl. In the southern Gezira, where rainfall is higher, the danger of a severe outbreak of blackarm is always present. X. 1730 A, once it has been established, tends to grow away from the disease, but it is not resistant, though under Gezira conditions, it is resistant to leaf curl. The control methods against blackarm, including the sweeping up and burning of debris, seed treatments with mercury dusts, and a sowing date delayed beyond what is considered the optimum by the Sudan Plantations Syndicate, are expensive and wasteful. R. L. Knight is directing work at Shambat towards producing blackarm-resistant strains of each variety, and promising material has been produced which contains one factor for resistance, but it will not be complete until at least one and perhaps two more factors for resistance have been added. When this very highly resistant material has been produced (it should be available for bulking in 1946–7), it is expected to replace the present material and so render unnecessary the present expensive control methods. A review of the entire Egyptian cotton selection work showed that progenies of the X. 1730 series were not superior to X. 1730 A, and therefore selection should be mainly confined to the new blackarm-resistant X. 1730 strains. Selections made in the present season from the blackarm-resistant X. 1730 L were very promising.

The derivatives X. 1730 A, G, H, and J are more strongly resistant to leaf curl in the Gezira than their original parent, X. 1730. These strains are at least as susceptible as Domains Sakel at Shambat. The N.T. series tested are all very resistant, including N.T. 2/38, N.T. 2/39, and N.T. 97/40, which have been used by Knight as parents in blackarm resistance transference. Lecrem, formerly selected by Massey for resistance, has retained this character. Massey's Domains Sakel, formerly alleged to be fully susceptible, has shown a definite response to selection for resistance.

In almost every locality where it was tested, BAR. X. 1730 L showed a marked increase in ginning outturn over X. 1730 A, but needs greater blackarm resistance by the inclusion of the factor B_3 before selection is undertaken. Though X. 1730 L was attacked by blackarm, it gave a final yield in one test of 5·42 kantars of seed cotton per feddan, in spite of the disease being given every advantage. In an adjacent plot, N.T. 2/40, also sown early, gave a seed cotton yield of 6·4 k. p.f. and showed conspicuous resistance to blackarm. Spinning tests on these blackarm-resistant strains gave promising results.

In genetics and breeding work at Shambat the addition of the *Gossypium punctatum* blackarm-resistance factor B_3 is being speeded up, both for N.T. 2 and X. 1730 types, and it is hoped to produce strains of these types containing both B_2 and B_3 within two years. A blackarm-resistance survey was made of most of the world's wild cottons. As resistance occurs both in the Old and New World diploids, it is possible that both forms of resistance can together be added to the New World cultivated types.

In Equatoria (Anglo-Egyptian Sudan) an examination of two variety tests six to eight weeks after sowing showed that X.A. 129 had by far the largest number of plants affected by blackarm. S.P. 84 and Deltapine each had about a quarter of the number, while 511 E and N.T. 43/37 had a tenth and a twentieth, respectively.

In preliminary work on blackarm resistance, it became evident that B_2 provides a very useful degree of resistance under Equatoria conditions. B_3 also seemed of value, but was available only in Sakel types, so that its value in American breeding work remains conjectural. A preliminary investigation of the value of B_2 made in Luluba by picking the resistant and susceptible plants separately in a plot of Uganda S.P. 84 showed that the resistant plants gave 14·4 per cent. more yield than the susceptible.

Conditions in Equatoria, particularly on the west bank of the Nile, do not favour a blackarm epidemic as much as the conditions do in Kordofan or the Gezira during the rains. The low temperatures in Equatoria greatly increase the incubation period of the disease, and plants sprayed with *X. malvacearum* at Maridi and Luluba took twice as long to show symptoms of the disease as they would have done in the Gezira. This alone considerably reduces rapidity of spread in Equatoria. In addition, lower temperatures delay germination and provide an added opportunity for any phage in the soil to destroy the organism. Rainfall in Equatoria, particularly on the west bank of the Nile, is usually almost vertical, and the sweeping 'horizontal' rain of the Gezira storms seldom, if ever, occurs. Thus, spread takes place by surface wash and rain splash off the ground; a small ridge of earth, sufficient to stop wash from one sub-plot to another, checked the spread of blackarm for several weeks. The climate of Equatoria also favours rapid disintegration of vegetable material, and no case suggestive of a carry-over of blackarm infection from a previous crop could be found. Where volunteer plants grew from wind-blown seed outside the cotton areas, the growth of tall grass round them screened them effectively. Examination of numerous native areas on the west bank of the Nile showed that the seed was the chief, if not the only, source of carry-over. All the areas were sown with resistant 511 D, and the average amount of primary or seed-borne infection was 0·8 per cent. As a result of all these factors, blackarm is unlikely ever to cause crop failures in Equatoria save in a very exceptional year.

In Uganda, attempts are being made to transfer resistance to blackarm and possibly to *Verticillium dahliae* from B. 181 to B.P. 52, while it is also desired, if possible, to transfer the high-yielding characters of the former. B.P. 52, which is locally the standard variety, is seriously contaminated, and steps are being taken to re-purify this strain for later distributions throughout the western half of Uganda. Breeding work has been designed primarily for the improvement of B.P. 52 in relation to blackarm. Secondary lines of work are the search for heritable resistance to *V. dahliae* and to its transference to B.P. 52.

Among the wide range of material collected at Serere in the last three years, the B_2 character for resistance in *G. hirsutum* types appears to have been found. None of the chief strains at Serere is homozygous susceptible.

Reddening of cotton leaves, possibly due to a soil deficiency, was very prevalent at Lubaga, Tanganyika Territory. Real damage was done to cotton on the experiment farm in patches by an *Alternaria*, probably *A. macrospora*. One block was badly affected early in April; the plants held on to the bottom bolls, but shed everything else, and remained stunted all the season. Where the attack was lighter, leaf-shedding was followed by healthy new growth. There was a slight indication of strain variation in susceptibility. A *Cercospora* leaf spot, probably *C. gossypina*, was widespread but not, apparently, serious on Lubaga cotton. Patchy infection by *Ramularia areola* caused leaf-drop in May.

Blackarm, seldom serious in Nyasaland, was rife in January over the whole cotton area. A statistical comparison between the relative susceptibilities of the local cottons was obtained by counts in the trials of two strains, C.L. 20 and C.L. 119. Apart from C.L. 20, which showed marked susceptibility, few of the local cottons showed as many as 20 per cent. of plants with stem lesions, and in view of the long dry season that prevails it is not likely that blackarm will ever become

serious in Nyasaland. Mz. 561 showed fair resistance, and C.L. 119 was scarcely affected.

WEINDLING (R.). **A technique for testing resistance of Cotton seedlings to the angular leaf spot bacterium.**—*Phytopathology*, xxxiii, 2, pp. 235–239, 1 fig., 1944.

The technique devised by the writer at the South Carolina Agricultural Experiment Station for testing the resistance of cotton seedlings to angular leaf spot (*Phytomonas* [*Xanthomonas*] *malvacearum*) involved the inoculation of the seed of 20 varieties in suspensions of the pathogen for periods of five minutes and three hours and growing the resultant seedlings for three weeks at 27° to 35° C., the relative disease rating being based on the severity and speed of development of the lesions. In general, the varietal reactions of the seedlings tested under these conditions agreed with those of field plants. Thus, the percentages of infection in five representative varieties, viz.: S×P Egyptian (extremely susceptible), Shafter Acala (highly susceptible), Rogers' Acala (moderately susceptible), Stoneville 4–5 (tolerant), and Stoneville 4–8 (resistant), for the short and long inoculation periods were 100 and 100, 92 and 100, 48 and 86, 64 and 66, and 18 and 28, respectively, comparison of the more susceptible varieties being facilitated by the use of a disease index.

It will be noted that the Stoneville lines, unlike the other varieties tested, did not contract appreciably more infection after the longer inoculation period, which frequently resulted, however, in the appearance of necrotic spots on 4–8. This may point to the possession of a factor for resistance involving cotyledonary hypersensitivity, which would result in such rapid necrosis of the affected cells as to give the parasite little opportunity of producing the typical lesions. It is thought the method may serve as a rapid supplementary test in breeding disease-resistant varieties.

DRECHSLER (C.). **Three Hyphomycetes that capture nematodes in adhesive networks.**—*Mycologia*, xxxvi, 2, pp. 138–171, 5 figs., 1944.

The author gives technical diagnoses of three further fungi parasitic on nematodes [*R.A.M.*, xxii, pp. 386, 431], viz., *Arthrobotrys cladodes* var. *macroides* n.var., which occurs in decaying roots of *Viola tricolor* and in leaf mould in Maryland, and of *Dactylaria psychrophila* n.sp. on decaying leaves and stems of potato near Presque Isle, Maine. The third fungus is *A. arthrobotryoides*, which was isolated from leaf mould on deciduous wood near Presque Isle, Maine, and near Fairfax, Virginia.

PETCH (T.). **Notes on entomogenous fungi.**—*Trans. Brit. mycol. Soc.*, xxvii, 1–2, pp. 81–93, 1944.

In this further contribution [cf. *R.A.M.*, xxi, p. 451] the author describes observations on entomogenous fungi, including seven new species.

EMMONS (C. W.). **Misuse of the name 'Trichophyton rosaceum' for a saprophytic Fusarium.**—*J. Bact.*, xlvii, 1, pp. 107–108, 1944.

The name '*Trichophyton rosaceum*' is stated to be commonly misapplied in laboratories engaged in the testing of fungicides to be used against dermatophytosis of the feet. For instance, of 12 fungi received at the United States Public Health Service from various laboratories, labelled '*T. rosaceum*', ten were strains of a rapidly growing, diffuse *Fusarium* producing lavender to blue and reddish-purple colonies and (within 48 hours) immense numbers of septate, crescent-shaped spores, one was *T. mentagrophytes*, and one appeared to be a Basidiomycete. Saprophytic species of *Fusarium* abound in the soil and may be isolated from slimy concrete

floors, or the error may have arisen through the accidental contamination of cultures. In any case, the spurious '*T. rosaceum*' should be replaced for fungicidal testing purposes by another dermatophyte, but not the authentic *T. rosaceum* Sabouraud 1910, the slow growth and scanty sporulation of which render it unfit for the object in view.

Ruschmann (G.) & Bartram (H.). **Further studies of the injury of Flax fibres and linen yarn by bacteria and fungi.**—*Bastfaser*, iii, pp. 29–39, 1943. [German. Abs. in *Chem. Abstr.*, xxxviii, 6, pp. 1370–1371, 1944.]

Experiments were conducted to determine the efficacy of trosilin (I.G. Farbenind.), chloramine, and clorina (Heyden) in the control of *Alternaria tenuis*, *Cladosporium herbarum*, and other organisms concerned in the spoilage of flax fibres and linen yarns in German spinning mills [*R.A.M.*, xxi, p. 453]. In the cold state, the preparations were found to be less effective sterilizers than water heated to 80° to 100° C., but when warmed they were far superior to the latter. At 80°, for instance, the contaminants were entirely eliminated by one hour's exposure to 0·5 per cent. trosilin, 1 per cent. clorina, or 2 per cent. chloramine. Fungi succumb more rapidly than bacteria to this method of sterilization.

Creager (D. B.). **Report of Gladiolus disease control studies.**—*Gladiolus*, xix, pp. 112–125, 1944. [Abs. in *Chem. Abstr.*, xxxviii, 6, pp. 1313–1314, 1944.]

Fusarium core and brown rots were shown by a survey of commercial gladiolus plantings in Illinois to be the most serious trouble in the State, the latter type of infection involving the bases, sides, and more rarely the tops of the bulbs [*R.A.M.*, xx, p. 468]. The disease may be combated, though complete elimination is impracticable, by six hours' immersion of the bulbs in 0·5 per cent. (1 pint in 25 gals.) cresol solution (12 to 14 hours for bulblets), or in a mixture of $\frac{3}{4}$ lb. new improved ceresan and 1 oz. dreft in 25 gals. water (five and 30 minutes for bulbs and bulblets, respectively). The ceresan solution should be discarded after one treatment. Planting should be carried out as soon as possible after disinfection. Mercuric chloride should only be used for the combined control of *F.* rots and scab [*Bacterium marginatum*], since the bulbs of certain varieties are susceptible to injury from this chemical.

Hoppe (P. E.). **Gladiolus seed treatment.**—*Gladiolus*, xix, pp. 126–127, 1944. [Abs. in *Chem. Abstr.*, xxxviii, 6, p. 1314, 1944.]

Lots of 100 seeds each from the open-pollinated Maid of Orleans gladiolus were treated with various fungicidal dusts in a preliminary experiment and planted out in the greenhouse. The germination percentages (at a maximum height of 6 in.) were as follows: control 58, new improved semesan jr. (1 per cent. ethyl mercury phosphate) 48, spergon (tetrachloro-para-benzoquinone) 61, and arasan (50 per cent. tetramethylthiuram disulphide) 71.

Mitra (A. K.). **A new Ascomycetous fungus on Selaginella.**—*Curr. Sci.*, xii, 12, p. 329, 1943.

An Ascomycete belonging to the order Sphaeriales and family Sphaeriaceae has been observed growing on living *Selaginella chrysocaulos* in the Lloyd Botanical Gardens, Darjeeling. It is characterized by minute, black, globose, smooth, ostiolate perithecia, oblong to spindle-shaped, hyaline, bicellular ascospores (eight per ascus), and paraphyses, and thus agrees with published descriptions of the genus *Melanopsamma*, of which it is considered to be a new species. The minute perithecia are found superficially in groups at the tips of the shoots or sporangiferous spikes, and an interesting feature of the fungus is the growth of its hyphae from the

tips downwards along the vascular bundles, leaving other parts of the stem unaffected.

FREZZI (M. J.). **Muerte del Tamarisco, ocasionado por 'Botryosphaeria tamaricis', en Corrientes, Argentina.** [Death of Tamarisk caused by '*Botryosphaeria tamaricis*' in Corrientes, Argentina.]—*Rev. argent. Agron.*, ix, 2, pp. 110–113, 1 pl., 2 figs., 1942.

Botryosphaeria tamaricis (Cke) Theiss. & Syd. (*Ann. mycol., Berl.*, xiii, 3–4, p. 663, 1915) was isolated in pure culture in 1 per cent. potato dextrose agar and other standard media from the leaden-coloured, subsequently darkening twigs of tamarisk (*Tamarix gallica*) in a 1½ to 2-year-old planting at Bella Vista, Corrientes, Argentina, which was entirely destroyed by the fungus early in 1941, this being the first record for the country. Pycnidia and perithecia are produced in abundance on diseased material in nature, but no fructifications developed in culture. The clavate asci, 55·5 to 83 by 15 to 21 μ, are furnished with a pedicel, 45 to 9·5 μ, and contain two types of ascospores, one elliptical, continuous, hyaline, with a rounded apex, 18·5 to 27·5 by 9 to 11·5 μ, and the other fusoid, continuous, hyaline, tapering to a point, 21 to 32 by 4·5 to 7 μ; the pycnidia are typical of *Dothiorella*, with pycnospores measuring 17 to 25·2 by 6 to 8·5 μ.

Positive results were given by inoculation experiments through wounded bark only.

HIRSCHHORN (ELISA). **Una especie nueva del genero 'Tilletia' ('T. zundelii', n.sp.).** [A new species of the genus '*Tilletia*' ('*T. zundelii*', n.sp.).]—*Rev. argent. Agron.*, x, 2, pp. 186–189, 1 pl., 2 figs., 1943.

Tilletia zundelii n.sp. was found on *Setaria argentina* in Chaco, Argentina, causing hypertrophy of the ovaries and glumes. It is characterized by black, pulverulent sori, 4 to 11 by 3 to 4 μ, containing laminillae measuring 156 to 228 μ in diameter at the base and 78 to 99 μ at the apex, consisting of remnants of host tissue and enveloped by the fungus at various stages of development, with a profusion of hyaline cells and immature chlamydospores at the base; and globose chlamydospores 13 to 16 μ in diameter, with a dense, verrucose or dentate membrane, ½ to 1 μ thick. Attempts at chlamydospore germination were unsuccessful.

The presence of the above-mentioned laminillae in the sori, a feature which does not appear to have been described in connexion with *Tilletia*, raised some doubt as to the identity of the pathogen which was, however, referred to this genus by Dr. Zundel.

ORTON (C. R.). **Graminicolous species of Phyllachora in North America.**—*Mycologia*, xxxvi, 1, pp. 18–53, 1944.

This annotated list of 46 *Phyllachora* spp. on grasses in North America provides descriptions of each with synonyms, type locality, and geographical distribution, and gives a key to species and indices to species and hosts.

NORRIS (D. O.). **Pea mosaic on Lupinus varius L. and other species in Western Australia.**—*Bull. Coun. sci. industr. Res. Aust.* 170, 27 pp., 2 pl., 1 map, 1943. [Photo-lithographed.]

Descriptions are given of the symptoms induced by the pea mosaic virus on six species of lupin in Western Australia [*R.A.M.*, xxii, p. 469], namely, the closely related *Lupinus varius* and *L. pilosus*, which are considered together, *L. angustifolius*, *L. albus*, *L. mutabilis*, and *L. luteus* (sweet). On the two first-named, two distinct

phases of the disease may be observed: the primary develops 12 to 14 days after infection, when the young, semi-expanded leaves round the growing tip become markedly distorted, twisted, and abnormally pale, large, dark brown, necrotic spots appear on the leaflets, causing shrivelling and death, and light brown streaks on the stems and petioles, corresponding to necrosis of the underlying phloem tissue; unless the attack occurs late in the season, the flowers and pods are also involved, and seed production is inhibited or greatly reduced. After cessation of growth for a week or a fortnight, the diseased plants enter upon a well-defined secondary phase, characterized by the production of numerous new shoots from the axils of the upper part of the stem, which converts the top of the plant into a mass of spindly, erect shoots, up to 1 ft. in length, bearing dwarfed, malformed leaves and cupped, incurved leaflets, not exceeding $\frac{1}{2}$ in. in length, imparting to the leaf the aspect of a partly closed hand. The name of 'bunchy top' is inevitably suggested by this striking phenomenon. The leaflets are brittle and show a conspicuous vein-clearing mottle, occasionally accompanied by slight interveinal necrosis. Small, misshapen flowers may be produced, the scanty resultant pods, their thick, fleshy walls covered with sharp pimples and irregular ridges, containing one or two apparently normal seeds of low viability. 'Bunchy-top' plants do not mature normally but remain green and vigorous after the healthy ones have died off, until killed by the onset of the dry summer season.

On *L. angustifolius*, which is being increasingly used as a green manure in Western Australia, the symptoms agree closely with those described under the name of 'sore skin' by Chamberlain from New Zealand [ibid., xv, p. 28]. The symptoms of the mosaic on *L. albus* first appear in the young growing tips and spread to the lower leaves, which tend to shrivel and droop as a result of stem-streaking. Affected plants may either rapidly become necrotic and die, or persist in a half-dead condition for an indefinite period. *L. mutabilis* sustains little damage apart from slight stunting, the conspicuous foliar marbling and mild rugosity developing a fortnight after infection, having no other consequences. This reaction makes *L. mutabilis* a useful host for differentiation between pea and cucumber mosaics, which induce identical symptoms on *L. angustifolius*, whereas on *L. mutabilis* the latter virus causes a severe necrotic streaking but no mottling. *L. luteus* appears to possess considerable resistance to pea mosaic, which attacks only a few plants even in stands closely surrounded by heavily diseased susceptible species. Affected individuals are dwarfed and erect, with small leaves and somewhat distorted leaflets bearing irregular, scattered, dark green, often 'blistered' islands. The lower leaves may die and hang down round the stem, which is sometimes superficially necrotic. As in the case of *L. varius*, diseased plants of *L. luteus* are apt to produce a number of secondary flower heads to replace the abortive primary ones, but the acute 'bunchy-top' phase typical of the former species never develops in the latter.

Seed transmission of the pea mosaic virus was shown not to occur either in lupins or subterranean clover, but is suspected to play an important part in the perpetuation of the disease in peas through the summer. Failure to infect peas by the use of sap from infected *L. varius* plants is attributed to the action of the lupin sap on the peas. The disease is transmitted to lupins chiefly from peas, broad beans, and sweet peas, other secondary annual hosts including, besides *Trifolium subterraneum*, *Medicago denticulata* and *Lathyrus tingitanus*, the stems and petioles of the last-named bearing superficial purplish-black streaks and lines extending into the older leaflets, where the interveinal areas between parallel lines are yellowish, producing a peculiar longitudinal, striated pattern. The perennial shrub, *Cassia corymbosa*, believed to be here recorded for the first time as a host of pea mosaic, carries the virus through the summer. The symptoms are so mild in nature as to be readily overlooked, consisting merely in dark green veinbanding of the

leaflets, though greenhouse inoculations resulted in severe stem streak and some foliar necrosis. *Hovea trisperma* was the only other perennial legume contracting pea mosaic in inoculation experiments.

Of the nine species of aphids shown to be capable of transmitting the virus, namely, *Myzus persicae*, *Aphis laburni*, *A. citricidis*, *Pentatrichopus tetrarhodus*, *Canariella aegopodii*, *Macrosiphum gei*, *M. rosae*, *A. gossypii*, and *Rhopalosiphum pseudobrassicae*, the first-named is likely to be the most important under Western Australian conditions.

In general, susceptibility to pea mosaic in lupins would appear to be correlated with a low alkaloid content, an increase in which involves a loss of palatability to the insect vectors, but this observation does not apply to the nearly alkaloid-free, highly resistant *L. luteus*.

No great economic importance need be ascribed to pea mosaic of lupins at present.

De Soriano (Angela M.). **Contralores microscópicos y microbiológicos en mantecas.** [Microscopic and microbiological counts in butter samples.]—*Rev. argent. Agron.*, ix, 3, pp. 193–203, 1942. [Received June, 1944.]

During a period of five months the writer conducted 1,465 analyses on 155 samples of butter from 24 Argentine dairies, using the two standard American methods of W. S. Greene (*Food Industr.*, September, 1935) and Wildman [*R.A.M.*, xvi, p. 536]. The former technique, which involves the enumeration of all the colonies produced on a plate culture by hyphae and spores, and not merely those of hyphal fragments exceeding a certain length, was found to be preferable for the object in view. An inverse relationship was found to exist between the yeast and mould populations of the samples, those poor in the former being rich in the latter and vice versa. The numbers of yeasts and moulds per ml. ranged from 0 to 100,000 and 0 to 225,000, respectively, for the products of the 24 dairies.

Tindale (G. B.). **Cool storage of Apples. Gas storage and skin coating experiments.**—*J. Dep. Agric. Vict.*, xlii, 3, pp. 124–129, 1944.

In experiments carried out in 1943 in Melbourne, Jonathan, Delicious, Rome Beauty, Stewart's Seedling, Democrat, and Granny Smith apples picked at three stages of maturity in March and April were promptly placed in gas storage and held there until late in December, all being covered with oiled wraps against superficial scald. Controls, also in oil wraps, were kept at the same temperatures in air, and in other tests the apples were given skin-coating treatments and then placed in ordinary cool storage at the same temperatures. In all the treatments, the Jonathan and Delicious apples were kept at 36° F. until the end of April, then at 34° to the end of May, and afterwards at 32°. The Rome Beauty, Stewart's Seedling, and Granny Smith apples were stored at 32° continuously in all tests.

Under all the conditions of storage, complete control of soft scald [*R.A.M.*, xxii, p. 316] and almost complete control of breakdown [ibid., xxii, p. 212] was obtained with the Jonathan variety, but breakdown was not controlled in Delicious. Further work demonstrated that much better control of breakdown resulted from storing at 40° until the end of April, at 36° during May, and at 32° subsequently. All the varieties kept much better in refrigerated gas storage than in air at the same temperature. In gas storage there was virtually no loss from disorders in Jonathan, Rome Beauty, and Granny Smith, but there was considerable breakdown in Delicious and Stewart's Seedling, the former variety also showing superficial scald. Gas storage increased the storage life of all varieties by about 50 per cent., as compared with air storage, while the skin-coatings increased the storage life by about 25 per cent. Two skin-coatings (castor-oil shellac and vac-guard) overcame Jonathan spot, and both, as well as spartan fruit emulsion, which was

the third form of coating used, appeared to equal oil wraps in overcoming superficial scald in Granny Smith.

It is concluded that, under Victorian conditions, 20 per cent. of the apple crop should be stored in 5 per cent. carbon dioxide for marketing in late October, November, and December. Granny Smith and Democrat apples are particularly suitable for this purpose. A large proportion of the remainder of the crop should be given a skin-coating treatment before being placed in cool storage.

JAHN (E.). **Untersuchungen zur Prüfung kupferfreier und kupferarmer Fusikladium-Bekämpfungsmittel im Laboratorium und bei künstlicher Infektion im Gewächshaus.** [Investigations on the testing of preparations containing no or little copper for *Fusicladium* control in the laboratory and by artificial inoculation in the greenhouse.]—*Arb. biol. Anst.* (*Reichsanst.*), *Berl.*, xxiii, 4, pp. 457–481, 2 figs., 1 graph, 1943.

It was found practicable, in these experiments at the Biological Institute, Dahlem, Berlin, on the control of apple scab (*Fusicladium dendriticum*) [*Venturia inaequalis*: *R.A.M.*, xxii, p. 391] by means of sprays containing little or no copper, to preserve conidial inoculum, either from 80 per cent. beer wort agar cultures or from artificially infected leaves, for several months in a viable state at a temperature of 0° C. Conidial germination begins two hours after planting-out at a temperature range of 2° to 20° without significant deviations in the germination percentages either at this juncture or after longer periods. At 27° and 30° germination is much reduced, but on restoration to room temperature eight hours later, conidia exposed to the higher range proceeded to germinate almost normally. Satisfactory percentages of germination were obtained in distilled water at P_H4 and in tap water at $P_H6 \cdot 5$ to 8; no germination occurred at P_H9, but the conidia retained their viability. Germination was not affected by light, darkness, or the colour of the light (blue, green, yellow, or red) transmitted through glass filters. Appressorial formation, on the other hand, was stimulated by high-wave light. The conidia were not injured by desiccation on cover-slips for periods up to four days, or by the interruption of germination after 24 hours for a similar period of drying. The mycelium grew through a temperature range from 0° to 27°, with an optimum at 18° to 20° (P_H7), no development occurring at P_H8.

In greenhouse inoculation experiments on two- to three-year-old potted trees from selected stocks and open-pollinated seedlings, the uppermost two or three leaves contracted the maximum amount of infection, the older dark green leaves being less frequently attacked, and then principally at the bases or along the petiole. Fairly young cotyledonary leaves also proved susceptible. The time of year at which the experiments were conducted did not appear to affect the outcome. Neither temporary rises in temperature up to between 25° and 28° nor the transient desiccation of the conidial suspension used as inoculum interfered with the course of infection. Since the newly formed conidia do not invariably emerge in large numbers on the epidermis, staining of the leaves is often necessary to verify the success of the inoculation tests. A plant once attacked contracts further infection in each new series of trials. Generally speaking, control experiments in the greenhouse with preparations containing little or no copper (designated only by numbers) on the above-mentioned material yielded results agreeing with the laboratory data as to the effects of the same fungicides on conidial germination. There were, however, certain discrepancies between the degree of control afforded by a given preparation in different series of tests, as well as between the data obtained in greenhouse and field trials, in which pears were also treated against *F. pirinum* [*V. pirina*]. The wetting and adhesive properties of the sprays and their resistance to washing-off by rain are the properties to be chiefly considered in a comparative assessment of their efficacy in relation to environmental conditions.

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HIRSCHHORN (ELISA). **Un nuevo parásito de 'Sorghum sudanense' en la Argentina.** [A new parasite of *Sorghum sudanense* in Argentina.]—*Rev. argent. Agron.*, viii, 3, pp. 262–263, 1 pl., 1941. [Received June, 1944.]

Cintractia [*Sphacelotheca*] *sorghi* [*R.A.M.*, xx, p. 240] was found in March, 1941, destroying the inflorescences of Sudan grass in various localities of the Province of Buenos Aires, where the crop (a new host of the smut in Argentina) serves as a valuable annual fodder.

OLIVE (L. S.). **Spermatial formation in Gymnosporangium clavipes.**—*Mycologia*, xxxvi, 2, pp. 211–214, 2 figs., 1944.

The spermatia of *Gymnosporangium clavipes* were found, upon examination of stained material, to be budded off through an open collar at the tip of each hypha. The young bud emerges through the collar and enlarges just above its rim, while nuclear division occurs in the spermatial hypha and a nucleus passes up into the developing spermatium. The mature spermatium is cut off by constriction at its base, the next bud appearing very soon in its stead at the mouth of the collar. The spermatium is thus primarily a uninucleate naked cell which originates as a bud from the protoplasm. There does not appear to be a cell wall round any of the spermatia in the cavity of the spermogonium, where they are surrounded by a liquid medium of nectar, but a thin wall may be seen round some of the spermatia among the paraphyses, and even a conspicuous one around those discharged over the surface of the fruit. The formation of the cell wall is assumed to be a secondary phenomenon associated with the transfer of the spermogonium from a liquid medium to the air.

WORMALD (H.). **A Cylindrocladium as the cause of a shoot wilt of varieties of Plum and Cherry used for rootstocks.**—*Trans. Brit. mycol. Soc.*, xxvii, 1–2, pp. 71–80, 4 pl., 3 figs., 1944.

The *Cylindrocladium* causing wilting of plum and cherry layers at East Malling [*R.A.M.*, xxiii, p. 30] has now been isolated from small pieces of the tissues from lesions on layer shoots of plum, cherry, and peach, from sclerotia present on such shoots, from spores on a wilted layer shoot of apricot, and from spores on softwood plum cuttings and their leaves in a propagating frame. On agar media these strains never developed fructifications, but some strains did when inoculated into plum or cherry leaves or green shoots kept in moist chambers.

The sporophores are either scattered or arranged in groups of 10 to 25. Each consists of a main axis unbranched to a height of 48 to 95μ; several branches then arise at or near the same level, and the axis is generally continued beyond this to a total height of 190 to 285μ, and terminates in a piriform or clavate knob 8 to 10μ in diameter. The diameter of the sporophores is 6 to 9μ at the base, tapering to 4 or 5μ just below the branching. The terminal portion of the axis is about 2μ in diameter. The branches are so disposed, the longest being below, that the ultimate branches are at approximately the same height, while the spores form a sheaf-like

cluster around or at the side of the axis. The fertile branches divide cymosely two or three times; the phialides are short cells measuring 8 to 12 by 2 to 3μ, usually slightly curved, and each terminates in a single conidium. The conidia (phialospores) are cylindrical with rounded ends, hyaline, bicellular, within the range 41 to 64 by 4 to 6μ. Sometimes one end of a spore is broader than the other by about 0·5μ. In some spores, one cell is narrower than the other for its entire length, usually by about 1μ. The conidia germinate readily and on prune agar at 25° C. form colonies 3 to 4 mm. in diameter in 48 hours.

In its sporophores and spores the fungus shows no great difference from *C. scoparium*, described by Morgan from *Gleditschia* in 1892. In its cultural characters, on the other hand, it is quite distinct from the form of *C. scoparium* found by Massey (*Phytopathology*, vii, pp. 408–417, 1917) on roses in the United States. Cultures of *C.* from Canada, two from strawberry roots and one from a raspberry root, were found to show a growth habit resembling that of strains isolated at East Malling from plum, cherry, and apricot layer shoots, and not that of the *C.* attacking roses in the United States. On the other hand, an isolate from *Acacia mollissima* roots in South Africa behaved in culture rather like Massey's fungus. In all these strains the spore size was about the same. Morgan does not mention any cultural characters, and for the present the author's fungus is regarded as a form of *C. scoparium* [*R.A.M.*, x, p. 756] Morgan distinct in its cultural characters from Massey's form on roses.

In inoculation tests in 1941, 14 plants of Common Mussel plum in one row were used. Four shoots on each plant were selected and marked, and one of the lower leaves of each was inoculated. On half the stools the midrib of each leaf for inoculation was severed by a cut. On the remaining plants the inoculum was placed on the midrib without wounding. In each batch of seven plants four were inoculated with the fungus and three with sterile agar. A monospore isolate from a Pershore plum leaf was used as inoculum. Immediately after inoculation steam-sterilized soil was added to the pots to cover the inoculated leaves. The inoculations were made on 30th May. Final counts of wilted shoots on 29th July showed that in the inoculated stools 118 shoots out of 126 (93·6 per cent.) died, compared with 8 out of 102 (or 7·8 per cent.) in the controls.

The available evidence suggests that the fungus is a soil organism. Stocks from an infected layer row should not be used for starting a fresh plot of layers. Spraying the growing shoots at earthing with Bordeaux mixture was found to reduce the risk of infection. Planting strawberries or raspberries on infected soil should be avoided for some years.

WILSON (E. E.) & SCOTT (C. E.). **Dormant spraying with $Ca(AsO_2)_2$ for the control of brown-rot blossom blight in Apricot trees.**—*Blue Anchor*, xx, 3, pp. 8–9, 27, 1943. [Abs. in *Chem. Abstr.*, xxxviii, 6, p. 1314, 1944.]

Applied to apricot trees in late winter, a calcium meta-arsenite spray is capable of suppressing the development of a large proportion of *Sclerotinia laxa* spores, besides destroying those already present. The compound is fairly safe on Blenheim, Royal, and Tilton apricots, but causes severe damage to almonds. In one-year trials Burton prunes and Kelsey, Sharkey, and Formosa plums were not injured by the spray at a concentration of 2 lb. per 100 gals., which did, however, damage the Pond plum; Wickson plums sustained no adverse effects from the treatment over a three-year period.

JAUCH (CLOTILDE). **La 'viruela de la púa' en los Durazneros y Almendros del nordeste Bonaerense.** [The 'constriction disease' of Peach and Almond trees in north-eastern Buenos Aires.]—*Rev. argent. Agron.*, viii, 3, pp. 206–215, 2 pl., 1941. [Received June, 1944.]

The outstanding results of the author's studies on the 'constriction disease'

affecting peaches and almonds in north-eastern Buenos Aires and elsewhere in Argentina and in the vicinity of Montevideo, Uruguay, have already been summarized from another source [*R.A.M.*, xxi, p. 185]. In agreement with Canonaco [ibid., xv, p. 731] and J. W. Roberts [ibid., xx, p. 310], the disease is attributed to the agency of a *Phomopsis*, and not to that of *Phoma persicae* [ibid., xiv, p. 15].

HILDEBRAND (E. N.). **New strain of Agrobacterium rubi from Boysenberry.**—*Phytopathology*, xxxiv, 2, pp. 259–260, 1 fig., 1944.

Cultures derived from boysenberry (*Rubus ursinus* var. *loganobaccus*) canes severely distorted by galls near Auburn, New York, appeared to be identical in growth characters, morphology, and physiology with those of *Agrobacterium (Phytomonas)* [*Pseudomonas*] *rubi* [*R.A.M.*, xx, p. 373] from blackberry of an organism isolated about the same time from black raspberry (*R. occidentalis*) in a garden at Ithaca, New York. Inoculations with cultures from both boysenberry and *R. occidentalis* into new canes of the latter at midsummer resulted in the production of galls, which reappeared in the following season even after their removal by pruning down to 12 in. below the site of infection in late October, thereby affording positive evidence of the capacity of *P. rubi* to migrate through first-year canes as they approach dormancy. In comparative inoculation experiments with *A.* [*Bacterium*] *tumefaciens* and *A.* [*Bact.*] *rhizogenes*, the boysenberry strain of the cane gall organism, in contrast to that from black raspberry, stimulated within one month the development on wounded *Kalanchoë daigremontiana* stems of minute galls (2 mm. in diameter), from which *P. rubi* was reisolated and again successfully inoculated into the same host. The strain of *P. rubi* from boysenberry thus appears to be a new one extending the range of the organism beyond the genus *Rubus*.

SEN (P. K.). **Black-tip disease of the Mango.**—*Indian J. agric. Sci.*, xiii, 3, pp. 300–333, 2 figs. (1 col.), 3 diags., 3 maps, 1943.

The outstanding results of the author's studies on mango black tip, which have been in progress since 1939 and are here fully described and tabulated, have already been noticed from another source [*R.A.M.*, xxiii, p. 137]. In addition to the Province of Bihar, where these investigations were conducted, the disease has been reported from orchards in proximity to brick kilns in the widely separated regions of Bengal, the United Provinces, and the Punjab. Differences in varietal reaction to the injury appear to be connected with the number of lenticels per unit area of the skin, susceptibility coinciding with a high proportion of these structures. Practical suggestions for the reduction of black tip include the restriction of new kiln sites to a safe distance from valuable orchards—about a mile on the east and west and a half-a-mile on the north and south; stopping the working of kilns before the time of fruit-set (end of February); and the use of telescopic chimneys, 40 to 50 ft. high, to ensure dilution of the deleterious fumes.

VAN DER PLANK (J. E.). **The disinfection and protection of seed.**—*Fmg S. Afr.*, xix, 217, pp. 274–278, 1944.

This contribution, in a special seed production number of the journal, gives a brief, popular account of modern methods of seed treatment against disease.

ZÜRN (F.). **Rauchschäden und Metallhüttenindustrie. I. Säuren, insbesondere schweflige Säure, als Bestandteil der Rauchgase.** [Smoke injury and the foundry industry. I. Acids, especially sulphuric acid, as a component of smoke gases.]—*Metall u. Erz.*, xxxix, pp. 21–25, 48–51, 1942. [Abs. in *Chem. Zbl.*, cxiv (ii), 17, p. 1576, 1943.]

The influence of the acids emanating from foundry fumes, notably sulphuric acid, on plant life [cf. *R.A.M.*, xxi, p. 140] depends not only on the concentration

of the noxious principle, but also on the time of day, the season of the year, and the degree of susceptibility of the particular species involved. In this connexion the cultivation of 'smoke-resistant' plants is recommended for manufacturing centres. The symptoms of gas damage are described, control measures discussed, and full directions given for the application of various methods of investigation of the after-effects.

HUMFELD (H.) & FEUSTEL (I. C.). **Utilization of Asparagus juice in microbiological culture media.**—*Proc. Soc. exp. Biol., N.Y.*, liv, 2, pp. 232–235, 1943.

Asparagus butt juice appears to provide an excellent balance of nitrogen, sugar, and inorganic constituents for microbiological nutrition, containing 4 to 5 per cent. solids, of which the bulk is reducing sugar, and 0·07 to 0·13 per cent. total nitrogen. Cultured on this medium, *Bacillus subtilis* exerted a comparatively strong inhibitory action on the development of *Phytomonas michiganensis* [*Corynebacterium michiganense*] and other bacteria.

SHERWOOD (MARION B.), FALCO (ELVIRA A.), & DE BEER (E. J.). **A rapid, quantitative method for the determination of penicillin.**—*Science*, N.S., xcix, 2569, pp. 247–248, 1944.

The authors describe a new assay method for determining the potencies of antibiotic substances in terms of suitable standards. It is based on the comparison of the test solution with a standard filtrate, the liquids being added to filter paper disks placed on nutrient agar seeded with *B[acillus] subtilis*. The zone of inhibition is measured and expressed as a percentage of the standard.

WALLINGFORD (V. H.), HOMEYER (A. H.), & GRONEMEYER (HARRIET B.). **Inoculation of media for mold culture.**—*Science*, N.S., xcix, 2570, p. 266, 1944.

The following technique for the cultivation of *Penicillium* spp. in large flasks or bottles has been successfully employed at the Research Laboratories of the Mallinckrodt Chemical Works, St. Louis, Missouri, to obtain a uniform degree of inoculation and to produce an even growth over the entire surface of the medium. A homogeneous emulsion is prepared by warming and stirring 2·5 gm. gum tragacanth and 0·5 gm. lanoline in 100 ml. of water; 30 gm. of the mixture is placed in a 125 ml. Erlenmeyer flask together with five 12 to 15 mm. glass marbles, the flask plugged with cotton, sterilized, and then rotated or shaken to emulsify the lanoline while being cooled to 30° C. or below. The flask with the mixture can be stored in the refrigerator indefinitely. To prepare a spore suspension, the contents of one flask are poured on to a culture grown on agar in a 250 ml. flask, this shaken gently for several minutes in a horizontal plane, and 25 ml. of sterile water added to dilute the suspension. The inoculated flasks are thoroughly shaken and then incubated.

WILKINS (W. H.) & HARRIS (G. C. M.). **Estimation of the anti-bacterial activity of fungi that are difficult to grow on liquid media.**—*Nature, Lond.*, cliii, 3889, pp. 590–591, 1 fig., 1944.

To estimate the anti-bacterial activity of fungi that do not grow well in liquid media, the authors devised the following test, preliminary to that generally used in the Mycology Laboratory of the Department of Botany, Oxford University [*R.A.M.*, xxiii, p. 56]. A pure culture of the fungus is grown as a plate colony on 20 ml. of its most favourable medium (the most generally useful is 2 per cent. malt extract in distilled or tap water with 2 per cent. agar) and allowed to grow until it has attained a diameter of about 2 to $2\frac{1}{2}$ in., which may be anything from one to three weeks after inoculation; plates are then poured containing 20 ml. of nutrient agar to which has been added a suspension of the bacteria against which the test is to be made, and allowed to cool to between 50° and 45° C.; a disk of mycelium

and agar is cut from the fungus colony and dropped into the centre of the still warm bacterial plate, which is incubated at 37° overnight. Next morning, if bacteriostatic substances have been produced, there is a clear, bacteria-free zone around the edge of the disk. In the author's experience, the outcome of this test indicates the type of result to be expected if the fungus were to be grown in liquid medium. This procedure helps, therefore, to shorten the experimentation time, as the negative fungi can be eliminated forthwith.

HANSEN (H. N.) & SNYDER (W. C.). **Relation of dual phenomenon in Penicillium notatum to penicillin production.**—*Science*, N.S., xcix, 2570, pp. 264–265, 1944.

The results of a single-spore analysis of a stock culture of *Penicillium notatum* showed it to be a dual fungus [cf. *R.A.M.*, xxii, p. 490], composed of two physiologically as well as morphologically distinct constituents, namely a normal conidial or *C* type and an abnormal mycelial or *M* type. The *M* type, non-sporulating and producing a yellow pigment, was observed to arise repeatedly as a mutation in ageing colonies of the *C* type, even in cultures started from a single conidium, and is considered to be a function of physiological age. Pure cultures of the *C* type which are maintained in a state of youth by frequent transfers (conidia) tend to remain free of the *M* type. The *M* type is presumed to be the form which various workers have reported as being a poor producer of penicillin, and it is suggested that the highest yield of penicillin could probably be obtained by making frequent single-spore cultures of the fungus, selecting the most productive clone, and keeping this monotypically pure and free from recurring mutants.

FURRY (MARGARET S.) & ZAMETKIN (MARIAN). **Soil suspension method for testing mildew resistance of treated fabrics.**—*Amer. Dyest. Reptr*, xxxii, 19, pp. 395–398, 1 fig., 1 graph, 1943.

Full details are given of a method of testing mildew resistance in treated military fabrics of various types [see next abstract] by a method involving the inoculation of strips of the materials with a suspension of composted soil and their incubation for 10 to 14 days in the synthetic medium of Greathouse *et al.* [*R.A.M.*, xxiii, p. 266]. The soil used for the suspension was shown by inoculation tests on cotton duck to contain a variety of micro-organisms, of which *Chaetomium globosum*, *Metarrhizium* sp., and a species of *Fusarium* caused complete deterioration of the fabric, colouring it yellow-grey, yellow-green, and yellow-black, respectively, while the following were responsible for 60 to 75 per cent. loss of strength: *Acrostalagmus albus*, *Alternaria*, *Cladosporium*, *F.*, *Helminthosporium*, and *Papulaspora* spp., and one species of *Penicillium*; most of these moulds turned the fabric grey.

Five out of nine finishing treatments applied to 7 oz. cotton osnaburg were found to be satisfactory by the soil-suspension procedure, viz., 30 minutes' immersion in copper naphthenate emulsion, 20 gm. per 100 ml. water, at 25° to 30° C., the same period in cuprammonium hydroxide, 10 gm. per 100 ml., same temperature; ten minutes in a mixture of 1 per cent. lead acetate and 0·3 per cent. potassium dichromate, same temperature; and 16 to 18 hours in the natural dye extracts, cutch and osage orange [*Toxylon pomiferum*], both at 0·6 per cent., with copper sulphate 0·3 per cent. and the same amount of potassium dichromate, at a temperature of 100°. Two baths were given for the last three treatments. One of the other treatments, consisting of ten minutes' immersion at 100° in copper sulphate and soap (10 and 1 per cent., respectively), also afforded considerable protection, involving a loss of 25 per cent. in breaking strength compared with a maximum of 11 for the more effective procedures. In another test it was shown that a minimum of 0·5 per cent. copper in the form of copper oleate and resinate was required for adequate mildew control, as against 0·65 per cent. copper naphthenate [loc. cit.], the protective action of the latter, however, being more lasting.

BERTOLET (E. C.). **Observations on soil burial procedures.**—*Amer. Dyest. Reptr*, xxxiii, 1, pp. 21–24, 1944.

The method of soil burial for the testing of mildew resistance in fabrics used for various military purposes at Jeffersonville Quartermaster Depot [*R.A.M.*, xxiii, p. 71] differs in certain respects from the specifications laid down in the American Society for Testing Materials Standards, 1942 [ibid., xxii, p. 359]. For instance, the test specimens measure 6 by 4 in. cut with the longer dimensions parallel to the filling instead of 6 by 3 cut warpwise. Twelve instead of 20 samples of each fabric are cut, six for control purposes. The specimens are completely buried at a depth of $\frac{1}{4}$ in. for 14 days at $75° \pm 5°$ F. in place of the vertical partially exposed burial at 1 in. for six weeks at $90° \pm 5°$. Water-repellent finishes assist materially in the retention of the mildew inhibitor, and are applied to most of the fabrics tested.

In recent trials, 12·29 oz. duck containing 0·95 per cent. pentachlorphenol and resistant to fire, water, and weather was buried at depths of up to 4 in. for as long as six weeks without loss. When the same stuff was exposed to four months' weathering out-of-doors, followed by 14 days' soil burial, it lost 30 per cent. of its tensile strength. Water-repellent duck Nos. 4, 6, and 10, vat-dyed olive-drab No. 7, containing 0·46, 0·32, and 0·28 per cent. copper, respectively, were buried for as long as six weeks without loss, while water-repellent olive-drab No. 4 9·85 duck, containing 1 per cent. dihydroxydichlordiphenylmethane survived three weeks' burial with no loss of strength, both before and after leaching. Promising results were also obtained by the application of 0·75 per cent. phenyl mercuric triethanolamine lactate to water-repellent 9·85 and 12·29 oz. camouflage printed duck for use in jungle equipment, which withstood seven days' soil burial in a satisfactory condition; the data relating to longer periods of exposure were inconsistent, and actual service tests are necessary to establish the utility of the treatment.

GREEVES-CARPENTER (C. F.). **A mildew-proofing treatment.**—*Text. Mfr, Manchr*, lxx, 830, p. 82, 1 fig., 1944.

The problem of immunizing fabrics against mildew-forming bacteria and fungi—one of the most serious difficulties of the textile industry—is engaging the attention of Dr. F. J. Sowa in the United States. He claims the successful development of a series of chemical formulations which are now protecting many millions of yards of camouflage cloth, mosquito netting, and other military fabrics [see preceding abstracts] against infection, e.g. by *Aspergillus amstelodami*, *A. fumigatus*, *A. niger*, *Chaetomium globosum*, *Penicillium digitatum*, and *Scopulariopsis brevicaulis*.

The formulations are described as a group of complex organo-mercurial compounds covered by patent applications and differing radically in their structure from the common inorganic mercury salts, which tend to precipitate cumulative and toxic protein-type substances. With suitable modifications, the basic formulations can be adjusted to insure compatibility with all types of finishes. The process is known as 'Puratized', and at present the entire output of the requisite chemicals (except a small amount set aside for test purposes) is reserved for contractors supplying the United States Government with military fabrics. Various types of the process appropriate for specific purposes are indicated.

MCCUBBIN (W. A.). **Relation of spore dimensions to their rate of fall.**—*Phytopathology*, xxxiii, 2, pp. 230–234, 1 graph, 1944.

On the basis of available information on the rate of spore fall in still air published by A. H. R. Buller (Researches on Fungi [I, 1909]), W. A. McCubbin (*Phytopathology*, viii, pp. 35–36, 1918), and J. J. Christensen [*R.A.M.*, xxiii, p. 140], an attempt was made to establish a relation to spore dimensions permitting the reasonably accurate determination of the probable speed of fall of any spore. The published

rates of fall (mm. per second) (r) for 20 species are tabulated together with spore measurements in microns, the product of the spore dimensions ($l \times w$), the square root of the product and the ratio of $\frac{l \times w}{r}$, and in a graph the observed rates of fall for 19 (excluding *Helminthosporium sativum* on account of its anomalous position as regards shape from the standpoint of the present studies) are plotted against spore diameters to give the point series. There is further included a curve representing an arbitrary series of the values $\frac{l \times w}{40}$ (the average $\frac{l \times w}{\text{rate of fall}}$ for the 19 species was 39·67) or their equivalents, $\frac{d2}{40}$ (d = spore diameters), similarly plotted against spore diameters, the perpendicular scale thus serving to represent mm. per second for the rate-of-fall series and microns for the derived curve. A reasonably good coincidence between these curves is evident, and in so far as this coincidence may be relied upon a relation is established between simple spore dimensions and observed rates of fall, which may be used to predict the probable velocity of fall of any spore in the type group comprising spherical and oval spores, as well as those of cylindrical shape with hemispherical ends. The formula expressing this relation is: $\frac{l \times w}{40} = r$, the symbols to be used in the sense already indicated. Modifications of this formula are suggested for double-coned and fusiform spores. The spores of *H. sativum* were omitted from the initial calculation because they fall into a spore group belonging to the fusiform types.

No high degree of accuracy should be expected from the formulae given as they are derived from only a few determinations, but it is hoped that further spore-fall determinations will enable them to be revised to bring them into closer relationship with reality.

Robbins (W. J.) & Ma (Roberta). **Pseudopyridoxine and certain fungi.**—*Proc. nat. Acad. Sci., Wash.*, xxix, 6, pp. 172–176, 1943.

Continuing their earlier studies [*R.A.M.*, xxii, p. 218], the authors found that *Ophiostoma catonianum, Ceratostomella ips* No. 255, *C. montium, C. microspora, C. multiannulata, C. piliferum, C. pluriannulata*, and *C. ulmi* responded to pyridoxin as such. The physiological activity of pyridoxin was not replaced by *dl*-alanine. No evidence was obtained from these fungi of the existence of E. E. Snell's more active pseudopyridoxin.

Stokes (J. L.), Gunness (Marion), & Foster (J. W.). **Vitamin content of ingredients of microbiological media.**—*J. Bact.*, xlvii, 3, pp. 293–299, 1944.

Some dehydrated ingredients of microbiological culture media in common use, e.g., the various peptones, yeast and meat extracts, and the like, were assayed for their content of thiamin, riboflavin, panthothenic acid, nicotinic acid, biotin, pyridoxin, folic acid (the name originally applied by H. K. Mitchell *et al., J. Amer. chem. Soc.*, lxiii, p. 2284, 1941, to a factor in spinach essential to the growth of *Steptococcus lactis* R and *Lactobacillus* spp., and here used to cover any substitute for this factor in the development of *L. casei*), and para-aminobenzoic acid. The vitamin values of these ingredients are compared with the amounts recorded in the relevant literature as requisite for the optimum growth of various micro-organisms. The following were the requirements (in microgm. per c.c. of medium) of the fungi included in the tests: *Saccharomyces cerevisiae*, 0·00007 biotin and 0·004 pyridoxin; *Rhodotorula rubra* and *R. flava*, 0·016 thiamin; *Phycomyces blakesleeanus*, 0·02 thiamin; *Neurospora sitophila* and *N. crassa*, 0·10 pyridoxin and 0·0025 para-

aminobenzoic acid, respectively, and *Ceratostomella ulmi*, 0·03 pyridoxin [*R.A.M.*, xxii, p. 218].

Van der Plank (J. E.). **Production of seed Potatoes in a hot, dry climate.**—*Nature, Lond.*, cliii, 3889, pp. 589–590, 1944.

Studies in South Africa showed that very high temperatures and low humidities check the flight of aphids that transmit potato virus diseases [cf. *R.A.M.*, xxiii, p. 274]. These results, in conjunction with the findings of other workers that low temperatures and high relative humidities have the same effect, are taken to indicate that at both ends of the scale there is an extreme at which the potato will thrive, but not the aphids, and that it is in the intermediate climates that heavy infestation may be expected to occur. Under field conditions, there appeared to be an optimum temperature for the aphids *Myzus persicae* and *Macrosiphum solanifolii* [*M. gei*] at which infestation is at a peak, and rising temperatures above this optimum progressively reduce the aphid population until a point is reached when the average daily maximum temperature for the summer months is 32° C., at which it virtually disappears. It is pointed out, however, that this applies only to the above-mentioned aphids on potato, and that high temperatures will not control all aphids on all crops.

At Kimberley, winter rains, which favour the aphids, are stated to be negligible, and the rising temperatures in early spring with the resulting dryness of the air keeps the aphids in check, so that two crops of potatoes can safely be grown per year. Aphid counts carried out during three seasons on thousands of leaves in hundreds of acres of potato in all stages of growth at the Vaal Harts and Riet River irrigation settlements near Kimberley showed, for *Myzus persicae*, an average of 1·1 per 100 expanded compound leaves, the highest record being 3·6 per 100 in April, when the danger of virus spreading was presumably almost past. Over 1,000 tons of seed potatoes raised in 1943 by the State in these two settlements proved to be the best ever available in bulk in the country. The only variety so far produced in quantity in South Africa is Up-to-Date, which is field-immune from virus A and manifests symptoms in hot weather of all other potato virus except X, but a start has been made with Katahdin.

Gradinaroff (L.). **Ueber die Aetiologie komplexbedingter Knollenfäulen bei der Kartoffel.** [On the etiology of Potato tuber rots of complex genesis.]—*Arb. biol. Anst. (Reichsanst.), Berl.*, xxiii, 4, pp. 405–428, 3 figs., 1 diag., 1943.

A comprehensive, tabulated survey is given of the writer's studies at the Bureau of Genetics and Plant Breeding, Sofia, Bulgaria, on potato tuber rots of complex etiology, the outstanding results of which may be summarized as follows. In inoculation experiments with *Fusarium avenaceum*, *F. sambucinum*, *F. culmorum*, *F. solani*, and its var. *martii*, obtained from Dr. Wollenweber and grown on 2 per cent. malt extract agar, the fungi failed to cause rotting of the tubers, but the five varieties tested did not react uniformly to infection. For instance, *F. avenaceum* induced moderate necrosis and slight aerial mycelium formation round the site of inoculation in Erstling [Duke of York], Frühgold, Flava (necrosis of variable extent), and Erdgold, while in Ackersegen the necrotic symptoms were severe, though the amount of mycelium was no greater than on the other varieties. *F. sambucinum* was responsible for severe necrosis in Flava and Erdgold, moderate in Frühgold, slight in Duke of York, and none in Ackersegen, with sparse mycelial growth in all except Flava. Moderate necrosis was induced by *F. culmorum* in Duke of York, Frühgold, and Erdgold, slight in Flava, and none in Ackersegen, accompanied by scanty mycelial growth in the three last-named varieties. Frühgold did not respond in any way to inoculation with *F. solani*, which also further caused only mild symptoms in the other varieties, whereas its var. *martii* produced extensive necrosis

on Duke of York and Ackersegen, moderate on Erdgold, and slight on Flava; mycelial development in this species was slight in Duke of York and Erdgold, variable in Frühgold, and absent in Ackersegen. *F. solani* var. *martii* was the only one of the species tested to produce conidia in fluctuating amounts on Duke of York, Frühgold, and Erdgold. In comparative trials with the ubiquitous moulds, *Penicillium glaucum*, *Aspergillus niger*, and *Rhizopus nigricans* [*R. stolonifer*], only the last-named caused any necrosis, and that slight, in Duke of York and Ackersegen. In this connexion it may be of interest to note that the ordinarily saprophytic *A. niger* was found by K. O. Müller in Anatolia, Turkey (unpublished report to the Turkish Ministry of Agriculture, 1928–9) developing in such profusion on grapes as to render the crop worthless for processing into currants. From the same source it was learnt that *R. stolonifer* was responsible for a decay of sunflower stems immediately below the inflorescences in Adana, Turkey.

Tubers attacked by *Phytophthora infestans*, especially those of Flava, provide a favourable nutrient substratum for *F.* spp. and *R. stolonifer*, which do not, however, behave as pure saprophytes in this instance, since they colonize the infected tissues before the cells have undergone complete necrosis. At the same time, the well-known late blight syndrome presents a modified aspect, the characteristic brown discoloration of the diseased tissues (phlobaphen formation in the collapsed cells) being absent or inconspicuous, while a prominent feature is liquefaction of the tuber tissues associated with the dissolution of the middle lamellae by the 'adventitious' fungi. In the case of varieties semi-resistant to late blight, such as the 'W' types, BRA 6/33, BRA 9/31, and BRA 13/31 [*R.A.M.*, xxi, p. 501], the secondary invaders do not thrive, probably, as K. O. Müller suggests, owing to the secretion in the host cells undergoing necrotic dissolution of an inhibitory microbicidal substance. Living Duke of York and Ackersegen tubers exposed before inoculation to supra-maximal temperatures (30°, 35°, 40°, and 45° C.) acquired a susceptible reaction to fungi incapable of attacking normal material, more particularly *R. stolonifer* and *F. culmorum*. On the other hand, the development of *P. infestans* on pre-treated susceptible tubers was scantier than on the controls, indicating that a decline in vitality does not necessarily connote any weakening of resistance to late blight. In the case of the resistant BRA 6/33, the high-temperature pre-treatment neither decreased nor enhanced the capacity to withstand infection by *P. infestans*.

These experimental data readily explain the frequent occurrence on rotting tubers of fungi giving negative results in pathogenicity tests on normal specimens. On the one hand, such manifestations may be the result of a complex of rots introduced by the late blight parasite, while on the other they may represent a condition arising only when the constitution of the tubers is modified by external factors in the direction of lessened resistance.

Beaumont (A.) & Large (E. C.). **Potato spraying in the south-west, 1942 and 1943.**—*J. Minist. Agric.*, li, 2, pp. 71–75, 1944.

The evidence obtained in demonstrations of spraying for the control of potato blight [*Phytophthora infestans*: *R.A.M.*, xxi, p. 345] in south-western England has shown clearly how erroneous is the view held by some growers that damage is only slight if the tubers do not suffer unduly. In 1942, most of the unsprayed potatoes were completely defoliated by the end of August, when tuber growth ceased. Two spray applications were made in the demonstration fields, at the beginning and end of July, the gain in yield from the spraying ranging from 2·5 to 5·2 tons per acre. In 1943, one of the worst years in living memory for blight, two sprays given in 14 centres on Majestic from 'A' certificate seed and from old, uncertified seed, resulted in a gain from spraying averaging 2 tons per acre for the former, as against only 0·8 for the latter.

So-called potato 'rust', usually associated with potash deficiency [ibid., xxii, p. 105], is often responsible for the apparent failure of spraying to increase yields. In two centres, the plants dried up owing to 'rust' before blight could make much difference. Also, apart from 'rust', the gain from spraying, like the total yield, was less on poorer than on better soils.

The use in 1942 of row-crop tractors on steeply sloping fields was a success. While the plants are only knee-high and still upright, the tractor outfit, with wheels adjusted to the width of the rows, causes practically no damage. For the second spraying, it was only occasionally necessary to use a horse. When the haulms are very heavy and sprawling, the sprayer wheels inflict a good deal of cutting, but it is better to sustain this loss than have all the haulms destroyed by blight. The sprayers apply 100 to 120 gals. per acre. A 500 gal. closed tank and a small rotary pump driven by a $1\frac{1}{2}$ h.p. petrol engine were mounted with the sprayer, on a lorry. The tank was filled at a river and water transferred to the sprayer as required.

Analyses of sprayed leaves showed no cuprous oxide or other proprietary spray equal to Bordeaux mixture in its ability to resist washing-off by rain. Used at the rate of 120 gals. per acre, 1 per cent. Bordeaux mixture (12 lb. granulated copper sulphate, 15 lb. hydrated lime) costs 4*s*. 9*d*. per application per acre as against 8*s*. 6*d*. per application of 6 lb. per acre for cuprous oxide. Spraying contractors, using a proprietary material, generally charge about 25*s*. per acre for each application, the farmer providing the water.

SHERF (A. F.). **Infection experiments with Potato ring rot and the effect of soil temperature on the disease.**—*Amer. Potato J.*, xxi, 2, pp. 27–29, 1944.

Experiments carried out in a greenhouse in New Jersey during 1940–1 and 1941–2 on the effect of soil temperature on potato ring rot (*Phytomonas sepedonica*) [*Corynebacterium sepedonicum*: *R.A.M.*, xxiii, p. 148] showed that at soil temperatures of 14° and 18° C. there was 50 per cent. infection from seed piece inoculation with a contaminated knife, while only about 5 per cent. occurred at 22° to 30°. At 18° the time taken for the symptoms to develop averaged 63 days, at 14° 88 days. Nearly twice as many stolons and tubers were infected at 14° as at 18°.

Sprout inoculation by hypodermic injection averaged 73 per cent. infection with very little infection at 30°. Foliage symptoms usually developed in 44 to 60 days; they appeared more slowly at 14° than at the other temperatures. Maximum stolon and tuber infection occurred at 18° with progressively less at 22° and 26°, while none occurred in the one plant infected at 30° and very little at 14°.

At temperatures most favourable for potato growth, viz., 18° to 22°, about 25 to 30 days elapsed from the first appearance of the symptoms until the death of the plant.

Infected plants showing no leaf symptoms and with no bacteria in the aerial stems sometimes produced infected stolons and tubers. Plants with leaf symptoms and numerous bacteria in the stem showed no or few bacteria in the stolons and tubers. Most infected plants, however, had foliage symptoms and bacteria present in the stem. Occasionally, one stem showed severe symptoms and contained many bacteria, while another stem from the same seed piece remained healthy. Long stolons produced infected tubers less often than short ones. Tuber size was not correlated with percentage of tuber infection. The stem was the most reliable portion from which to obtain smears, which should be taken about 1 in. below the ground-line.

Inoculation with equal amounts of pure cultures of *Erwinia carotovora* and *C. sepedonicum* decreased the percentage of infection and increased the length of time required for symptom development, and gave a higher percentage of tuber infection with visible evidence of rot at the stem end of the tuber than did *C. sepedonicum* alone. However, soft rots of the pith of the tuber occurred in the absence of the

soft-rot organism and while the tuber was still attached to the plant, without any evident external symptoms in the tuber or stolon.

The ultra-violet light technique of Iverson and Kelly [ibid., xx, p. 549] when used by the author failed to detect some infected tubers. In laboratory tests, roccal (1 in 100) was an effective bactericide against the ring-rot organism. Some cultures of *C. sepedonicum* were still viable after 28 months on agar slants under mineral oil [ibid., xxii, p. 404].

THIRUMALACHAR (M. J.). **Ergot on Sugarcane in Mysore.**—*Curr. Sci.*, xii, 12, pp. 330–331, 1943.

Attention is drawn to the occurrence on sugar-cane arrows in Mysore of the elongated, yellowish-black sclerotia of ergot [? *Claviceps* sp.], hitherto recorded on this host only from the Philippines [*R.A.M.*, x, p. 440]. Arrowing sugar-cane varieties produce immense masses of flowers, and the author considers that this reaction opens an encouraging possibility for the large-scale production of ergot.

MERRILL (E. D.). **An index to Rafinesque's published technical names for the cellular cryptogams.**—*Farlowia*, i, 2, pp. 245–262, 1943.

In connexion with the author's recent discovery (*Proc. Amer. phil. Soc.*, lxxxvi, pp. 72–90, 1942) of the omission from standard botanical indexes of Rafinesque's validly published generic and specific names, a list is here given of those proposed by the latter or species belonging to 92 genera of fungi, 46 of which appear to have been generally overlooked by students of the cellular cryptogams since their appearance in 1834.

ROGERS (D. P.) & JACKSON (H. S.). **Notes on the synonymy of some North American Thelephoraceae and other resupinates.**—*Farlowia*, i, 2, pp. 263–328, 1943.

Among the cases of synonymy on North American Basidiomycetes (mainly Thelephoraceae) critically analysed by the writers in connexion with changes proposed in the nomenclature of this group during the last eight or ten years, the following may be mentioned. On the authority of Burt (*Ann. Mo. bot. Gdn*, iv, p. 240, 1917), and of Bourdot and Galzin (Hyménomycètes de France, p. 358, 1928), *Coniophora puteana* is preferred as a designation for the cellar fungus of timber to *C. cerebella*.

A study of the type collection of *Corticium areolatum* Bres. revealed distinct differences between it and *C. apiculatum*, to which it was referred by Burt [*R.A.M.*, vi, p. 125], and the former species is consequently upheld as valid. *C. areolatum* Stahel is identical with *Pellicularia filamentosa* (Pat.) Rogers [*C. solani*: ibid., xxii, p. 372]. The comparative study of large numbers of specimens is necessary to settle the taxonomic position of the *C.* spp. sect. *P.* Bourd. & Galz. centring round *C. arachnoideum* sensu Bres. and *C. centrifugum* sensu Bres., and such relative finality has not yet been attained.

An index is appended, indicating the systematic position of the various genera and species by means of variations in the type.

BEETLE (A. A.). **Specific decapitalization.**—*Chron. bot.*, vii, 8, pp. 380–381, 1943.

A number of recent papers dealing with botanical nomenclature are cited in support of the movement for the decapitalization of specific epithets. An amendment in the existing International Rules of Botanical Nomenclature in this sense is urged.

RAY (W. W.). **Notes on Oklahoma Cercosporae—III.**—*Mycologia*, xxxvi, 2, pp. 172–176, 1944.

This further list of *Cercospora* spp. from Oklahoma [*R.A.M.*, xxii, p. 79] includes

the following new species: *C. gomphrenae*, which forms circular, tan to dingy grey spots on leaves of *Gomphrena globosa*, 0·5 to 4 mm. in diameter, bordered by a wide red to purplish zone and produces unbranched conidiophores and hyaline conidia, 2 to 3·5 by 30 to 135 μ; *C. paspali* on leaves of *Paspalum stramineum*; and *C. staphyleae* on leaves of *Staphylea trifolia*.

KERN (F. D.) & THURSTON (H. W.). **Additions to the Uredinales of Venezuela—III.**—*Mycologia*, xxxvi, 1, pp. 54–64, 1944.

Another 25 species are added to the published lists of Venezuelan Uredinales [*R.A.M.*, xxiii, p. 42], bringing the total up to 263. A rust on maize, previously referred to *Puccinia pallescens*, is recognized as *Angiopsora A. zeae*, while *P.* [*A.*] *pallescens* is believed to be confined to *Tripsacum*. A new species, *Ravenelia mirandensis* is described on *Cassia tora*. The numerous spines on each teleutospore and the appressed cysts are stated to differentiate this species from the others known on *Cassia*, except *R. antiguana*, from which it differs in the lack of paraphyses, the smaller uredospores, and the smaller teleuto heads with fewer spores.

SINGER (R.). **Notes on taxonomy and nomenclature of the Polypores.**—*Mycologia*, xxxvi, 1, pp. 65–69, 1944.

This is a short extract of the classification of the Polyporaceae evolved in co-operation with A. A. Bondarzev, and submitted for publication in the Russian journal *Sovietskaya Botanika*, June, 1941, incorporating a few corrections since made.

GARCIA RADA (G.) & STEVENSON (J. A.). **La flora fungosa peruana. Lista preliminar de hongos que atacan a las plantas en el Peru.** [The Peruvian fungus flora. A preliminary list of fungi attacking plants in Peru.]—112 pp., Estac. exp. agríc., La Molina, 1942.

Many of the records in this list of parasitic fungi of Peru have already been noticed from other sources [*R.A.M.*, xi, p. 225; xix, p. 264, *et passim*], but reference may here be made to the following: *Synchytrium endobioticum* on potato [ibid., ix, p. 63] in the region of the Central Andes (Abancay, Matucana, San Mateo, and Ancash); *Urophlyctis alfalfae* on lucerne; *Bremia lactucae* on lettuce; *Phytophthora parasitica, P. citrophthora*, and *Phoma citricarpa* on citrus (the last-named specifically on sweet orange); *Dimerosporium heveae* and *Dothidella ulei* [ibid., v, p. 689; xxii, p. 495], agents of foliar diseases of *Hevea* rubber; a species of *Claviceps* (? *C. purpurea* or *C. microcephala*, with sclerotia 5 to 6 mm. in length [ibid., xvii, p. 269]) on *Poa candamaona*; *Elsinoe ampelina* on vine; *Melampsora lini* on flax (Departments of Lima Ica, Libertad, and Cajamarca); *Cercospora henningsii* producing large, chestnut-coloured spots on living cassava leaves [ibid., xxi, p. 242]; *C. musae* [*Mycosphaerella musicola*] on *Musa* sp.; *C. vaginae* and *Helminthosporium sacchari* (syn. *H. ocellum*) on sugar-cane; *Physalospora obtusa* and *Penicillium expansum* on apple; *Uromyces fabae* generally distributed on broad bean; *U. appendiculatus* and *Isariopsis griseola* on *Phaseolus vulgaris*; *Cerotelium fici* on fig (general); *Tilletia levis* [*T. foetida*] and *T. tritici* [*T. caries*] on wheat; *Corticium koleroga* on coffee; *H. oryzae* [*Ophiobolus miyabeanus*] on rice; *Nigrospora oryzae* on maize; *Stemphylium sarciniforme* on crimson clover (*Trifolium incarnatum*); *Fusarium bulbigenum* var. *lycopersici* on tomato; and *F. vasinfectum* on cotton. Exception is taken to Abbott's attribution of avocado scab to *Sporotrichum citri* [ibid., ix, p. 63]. There is, in fact, no certainty as to the occurrence of the causal organism, *Sphaceloma perseae*, in Peru.

A bibliography of 84 titles and fungus and host indexes are appended.

FITZPATRICK (H. M.). **A bibliographical study of the Icones Pictae Specierum Rariorum Fungorum of Christiaan Hendrik Persoon.**—*Mycologia*, xxxvi, 2, pp. 177–187, 4 figs., 1944.

Photographs of the title page, the fourth fascicle, and other parts of C. H. Persoon's 'Icones pictae specierum rariorum fungorum', which is stated to be a very rare book in North American libraries and often incomplete, have been prepared at Cornell University and sets of prints were offered to those wishing to complete their imperfect copies. The book is the companion volume to his 'Synopsis Methodica Fungorum'.

COSTA (A. S.). **Multiplication of viruses in the Dodder, Cuscuta campestris.**—*Phytopathology*, xxxiv, 2, pp. 151–162, 1 fig., 1944.

An account is given of the results of experiments conducted at the Rockefeller Institute for Medical Research from January to June, 1943, to determine the part played by dodder (*Cuscuta campestris*) in the transmission of four viruses [*R.A.M.*, xxiii, p. 247], viz., tobacco mosaic, [tomato] aucuba mosaic, cucumber mosaic, and cranberry false blossom [ibid., xxiii, p. 263]. The two first-named viruses were transmitted from tomato to Bonny Best tomato and tobacco by this means in a few cases where the dodder was taken directly from diseased plants, the incubation period ranging from 12 to 20 days, but in no instance was transmission effected after viruliferous dodder had been grown once or twice on immune lucerne or crimson clover. No multiplication of these viruses takes place therefore in dodder, the juice of which exerts an inhibitory effect on them, gauged by the number of local lesions secured on *Nicotiana glutinosa*.

A high percentage of transmission through dodder was obtained with the cucumber mosaic virus on Turkish tobacco and *N. glutinosa*. Moreover, viruliferous dodder stems, grown four times successively on immune red clover (corresponding to a dilution beyond the dilution end point of the virus), showed no diminution of virus content. The incubation period ranged from 9 to 20 days (9 to 12 in the majority of the test plants). Local lesions developed in four to five days near the point of attachment on broad bean plants supporting dodder stems containing the cucumber mosaic virus, suggesting that the virus increases in dodder, becoming systemic, and is transferred at the time of haustoria formation. As in the case of tobacco and tomato aucuba mosaic, the juice of dodder also exerted an inhibitory action on cucumber mosaic, measured by its toxicity to Black cowpeas. Dodder stems were successfully inoculated by rubbing with the cucumber mosaic virus, which induced a varying degree of growth distortion.

Cranberry false blossom was retained in *C. campestris* after six consecutive transfers on lucerne, which Kunkel has shown (in unpublished work) to be immune from this virus.

VALLEAU (W. D.), JOHNSON (E. M.), & DIACHUN (S.). **Root infection of crop plants and weeds by Tobacco leaf spot bacteria.**—*Phytopathology*, xxxiv, 2, pp. 163–174, 3 figs., 1944.

In addition to information already presented from another source [*R.A.M.*, xxiii, p. 281], the following points are of interest in this expanded account of field observations in Kentucky on the persistence in the soil of the causal organisms of tobacco angular leaf spot and wildfire (*Bacterium angulatum* [*Pseudomonas angulata*] and *Bact.* [*P.*] *tabacum*). In a test involving the inoculation of tobacco leaves with ten composite samples of soil collected along a fence row 4 ft. distant from a bed heavily infested with *P. tabacum* in a field of which the remainder had been ploughed and prepared for a new tobacco crop, nine induced the development of 1 to 75 wildfire spots, two also caused angular leaf spot, and one the latter alone. Of ten similar samples collected from weedy spots in the ploughed field (which had

been in orchard grass [*Dactylis glomerata*]—Korean *Lespedeza* pasture for the past five years), two induced wildfire alone, five both diseases, and one angular leaf spot only. When the individual weeds were tested, *P. angulata* was obtained from roots of ragweed [*Ambrosia artemisiifolia*], giant ragweed [*A. trifida*], white clover, vermifuge [*Artemisia* (?) *absinthium*], and *Oxalis*, and *P. tabacum* from those of *Lespedeza*, shepherd's purse [*Capsella bursa-pastoris*], white clover, ragweed, chickweed [? *Cerastium arvensis*], and orchard grass. At this juncture, some growers were already beginning to set tobacco.

Wheat roots having previously been shown to harbour both species of bacteria, surface-sterilized seeds were germinated in a damp chamber, and the developing roots inoculated by immersion in an aqueous suspension of one or other of the pathogens containing 1,000,000 to 2,000,000 cells per c.c. The plants were then placed on sterile moist paper towelling in Petri dishes, and in two to five days bacterial colonies were detected, mostly in the root-hair region, on 85 out of 96 inoculated roots. All the 40 root systems used as inoculum produced typical wildfire spots on tobacco leaves. When individual colonies were removed on a short piece of wheat root inoculated with one of the bacteria, crushed in water, and inoculated into tobacco leaves, angular leaf spot or wildfire developed. There is little doubt, therefore, that the colonies observed on the wheat roots were those of *P. angulata* and *P. tabacum*.

Bullock (J. F.) & Moss (E. G.). **Strains of flue-cured Tobacco resistant to black shank.**—*Circ. U.S. Dep. Agric.* 682, 9 pp., 3 figs., 1943.

Descriptive notes are given on four second back-cross F_4 selections of tobaccos resistant to black shank (*Phytophthora parasitica* var. *nicotianae*) [*R.A.M.*, xi, p. 407], which have been developed at the North Carolina Agricultural Experiment Station by hybridization between No. 301 and other cigar-wrapper strains with flue-cured varieties, e.g., Virginia, White Stem Orinoco, and Warne, and are now ready for release to growers. The new strains are designated Black Shank Resistant VBL-Strain 1 (Oxford 1), Black Shank Resistant VBL-Strain 2 (Oxford 2), Black Shank Resistant WSO-Strain (Oxford 3), and Black Shank Resistant W-Strain (Oxford 4). Of these, the first is barely distinguishable from the flue-cured parent, Virginia Bright Leaf, the second is similar, the third closely resembles White Stem Orinoco, and the fourth approximates in its growth habits to Warne.

During 1941, black shank was found to be generally distributed in the six counties of North Carolina already infested in 1932, and had further spread to three others, representing a distance of 200 miles from the nearest previously recognized focus of infection. In the course of 1937, the pathogen was conveyed to three counties of Virginia from Pitt County, North Carolina.

Vaughan (E. K.). **The use of ethyl mercury phosphate for treating Tomato seed in New Jersey.**—*Phytopathology*, xxxiv, 2, pp. 175–184, 1944.

New improved ceresan (ethyl mercury phosphate), at the rate of 1 in 24,000 or in any case not exceeding 1 in 20,000, proved as effective as mercuric chloride in the control of seed-borne tomato diseases, notably early blight (*Alternaria solani*) in New Jersey [*R.A.M.*, xxiii, p. 46], the period of immersion required being five minutes if followed by 20 to 30 minutes' drainage of the sacks of seed before centrifuging, or ten minutes if the latter process is to take place immediately after disinfection. An added advantage of ethyl mercury phosphate over mercuric chloride lies in the safety with which a residue of the former compound may be left on the seed coat, thereby helping to prevent recontamination of the seed and affording some protection against seedling damping-off. Ethyl mercury phosphate solutions lose some of their efficacy with repeated use [ibid., xxiii, p. 264], and should be discarded after one treatment. The fungicidal solution may be applied

with satisfactory results at a temperature range of 43° to 80° F., and may be made up either with tap or stream water. The seed may be treated either when freshly extracted or after drying, and stored from one season to the next in an appropriate container.

Other seed-borne pathogens of less importance locally than *A. solani* are *Phytomonas* [*Xanthomonas*] *vesicatoria*, *P.* [*Corynebacterium*] *michiganense*, and *Septoria lycopersici*.

REICHERT (I.), PALTI (J.), & MINZ (G.). **Field trials for the control of Tomato leaf diseases.**—*Hassadeh*, xxiii, 2–8, 12 pp., [? 1943. Hebrew.]

A detailed, fully tabulated account is given of five spraying trials for the control of tomato diseases carried out in co-operation with B. Capuler and S. Stoller from 1939 to 1942 in Palestine in the warm, humid coastal plain (near Tel Aviv), in the hot, moderately humid Jordan Valley (at Degania), and in the warm, rather dry eastern part of the Valley of Esdraelon (Tel Ainal). The most important of these diseases in Palestine are powdery mildew (*Oidiopsis taurica*) [*R.A.M.*, xvii, pp. 15, 217], leaf mould (*Cladosporium fulvum*), early blight (*Alternaria solani*), and leaf spot (*Septoria lycopersici*). Powdery mildew and early blight occur in all parts of the country in all seasons, while leaf mould attacks mainly autumn-grown tomatoes in the coastal plain and winter or spring crops in the Jordan Valley and the Valley of Esdraelon. During the trials, *S. lycopersici* made no appearance, and *A. solani* was only of quite secondary importance. Powdery mildew, however, caused strong infection in the Jordan Valley trial in 1941, and leaf mould severely attacked the tomatoes in the three trials conducted in the coastal plain.

The data obtained showed that spraying with the lime-sulphur preparations cita and sulfinette at a 1·5 per cent. concentration gave very effective control of powdery mildew, but copper sprays were only slightly effective against this disease. Excellent control of leaf mould was given by these same lime-sulphur washes, and also by sulfocide and shirlan AG (both at 0·5 per cent.), Bordeaux mixture (1 per cent.), and perenox (0·33 or 0·5 per cent.).

The powdery mildew control given by sulfinette in the trial in the Jordan Valley increased the yields by 50 per cent. (2,830 to 4,250 kg. per dunam = 1,000 sq. m.). The combined control of powdery mildew and leaf mould in the 1941 trial in the coastal plain given by cita lime-sulphur, sulfinette, and perenox with the addition of 1 per cent. white oil resulted in a very largely increased yield, though Bordeaux mixture and perenox without oil failed to give any conspicuous increase. The evidence suggests that Bordeaux mixture (1 per cent.) and perenox (0·33 per cent.) may injure tomato plants if applied at frequent intervals. They require to be tested at lower concentrations.

The observations made in the Jordan Valley in 1941 indicate that powdery mildew may be controlled there by lime-sulphur applications at about weekly intervals, even if spraying is delayed until after the first symptoms have appeared. The trials in the coastal plain demonstrated that leaf mould cannot be controlled by spraying at intervals of three weeks; spraying at intervals of four to five days gave effective control, however, and the choice of suitable intervals appears to be more important than that of a fungicide. In the Jordan Valley, the extra profit obtained by spraying makes frequent applications worth while. In the coastal plain, whether spraying is worth while or not depends on current market prices.

JENKINS (C. F. H.). **Thrips and their relation to spotted wilt and other plant injury.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xx, 4, pp. 272–275, 2 figs., 1943.

This paper discusses the part played by thrips in the spread of tomato spotted wilt [*R.A.M.*, xxii, p. 502], the most important disease of the crop in Western

Australia. Various formulae for baits, dusts, and sprays for controlling thrips are given [ibid., xxii, p. 115].

DODGE (B. O.). **Boxwood blights and Hyponectria buxi.**—*Mycologia*, xxxvi, 2, pp. 215–222, 2 figs., 1944.

Volutella [*Chaetodochium*] *buxi* and *Verticillium buxi* [*R.A.M.*, xx, p. 434], associated with the destructive leaf blight or die-back disease of boxwood [*Buxus sempervirens*], were assumed, in a previous study made in co-operation with Marjorie E. Swift [ibid., x, p. 34], to be simply different types of fructification of the same fungus. Later, however, doubts arose as to the correctness of that view. Unfortunately the perfect or ascocarpic stage, *Nectriella rousseliana* (Mont.) Sacc. (this name, and not *Nectria rousselliana*, is stated to be the correct one in accordance with modern usage), has never been found in nature. On a later occasion, box leaves infected by *Hyponectria buxi* were found to bear also the white growth of *V. buxi* and sporodochia of *C. buxi*. It is doubtful whether the three forms of fructification are stages of the same fungus, or whether there are two types of leaf blight or die-back, one caused by *H. buxi*, and the other by *Nectriella rousseliana*, both having similar conidial stages. It is suggested that studies of single-spore cultures of both *N. rousseliana* and *H. buxi*, followed by infection experiments, are necessary before the status of *C. buxi* and *V. buxi* can be determined.

CLAPPER (R. B.). **New Chestnuts for our forests?**—*Amer. Forests*, xlix, 7, pp. 331–333, 365, 7 figs., 1943.

Details are given of the hybridization experiments now being conducted by forest pathologists of the United States Bureau of Plant Industry at Glenn Dale, Maryland, with a view to the development of chestnuts resistant to blight [*Endothia parasitica*: *R.A.M.*, xxiii, p. 282] by crossing the native American *Castanea dentata* with Asiatic species, e.g., the Chinese *C. mollissima* and the Japanese *C. crenata*. Attempts are also in progress to breed blight-resistant chestnut-chinquapin hybrids to replace the susceptible native chinquapins of the Southern States and the Ozark Mountains of Arkansas as sources of food for animals. Three species appear to be specially promising for this purpose, namely, *C. seguinii*, *C. alnifolia*, and *C. paucispina* (possibly a variety of *alnifolia*).

BANERJEE (S. N.) & BAKSHI (B. K.). **Trametes floccosus Bres. in culture.**—*Sci. & Cult.*, ix, 8, pp. 352–353, 1 fig., 1944.

In July, 1942, fresh sporophores of *Trametes floccosus* were collected in large numbers from living and dead trunks of *Ficus religiosa* [one of the trees on which the lac insect is reared] at Calcutta and grown in pure culture on potato dextrose agar by C[lara] W. Fritz's method [*R.A.M.*, ix, p. 754]. In 30-day-old cultures the felty mat was predominantly white, but towards the upper advancing zone, patches of pale yellow-orange (Ridgway), and pale ochraceous-salmon appeared. Resupinate, pale buff fruit bodies with minute pore mouths were gradually formed and found on sectioning to contain numerous basidia with narrow elliptical, hyaline, smooth-walled basidiospores, 12 to 14 by 6μ, and a few cystidia. Spore deposits from one of these fruit bodies gave rise to new polysporous cultures, three of which also fructified in about a month. Inoculation experiments with the fungus on healthy wood blocks of *F. religiosa* are in progress.

HIRT (R. R.). **Distribution of blister-rust cankers on Eastern White Pine according to age of needle-bearing wood at time of infection.**—*J. For.*, xlii, 1, pp. 9–14, 1944.

A study of blister rust (*Cronartium ribicola*) infection of eastern white pine (*Pinus strobus*) under natural outdoor conditions at the New York State College of Forestry

from 1927 to 1938 showed that cankers developed on current-season and one- and two-year-old needle-bearing wood, the majority on one-year-old bark [cf. *R.A.M.*, xvi, p. 287; xix, p. 375]. These observations apply to three- to six-year-old trees potted the same season as needle infection occurred, to undisturbed natural reproduction three to seven years old, and also to seven other species of five-needled potted white pines, viz., *P. flexilis* and its var. *reflexa*, *P. monticola*, *P. aristata*, *P. peuce*, *P. koraiensis*, and *P. parviflora*.

Cankers on needle-bearing wood that was two years old at the time of exposure to infection were the first to appear on the bark. By the autumn of the following year these cankers had attained the size and aspect typical of those on current-season and one-year-old wood about $1\frac{3}{4}$ years after needle infection. When current-season needles contracted infection in July or August, most of the resultant cankers were visible in the autumn of the next year, but if infection was not established until September, the majority appeared only in the second spring, i.e., 20 to 22 months after the pathogen entered the host. The bulk of the cankers ensuing on infection of the one-year-old needles from July to September could be detected in the autumn of the next year, at which time just under 50 per cent. of those induced by the infection of current-season needles were discernible.

It is evident from these data that the use of sample white pine plots affords a means of close approximation of the relative amount of infection for any season by the autumn of the next year, while accurate conclusions can be reached by the following spring. The fact that the majority of cankers are formed on one-year-old wood is important in studies of the history of the rust in infection centres. Years of heavy infection may be determined by ascertaining the age of the nodal and internodal bark bearing the maximum number of similar-aged cankers, epidemics in all probability dating from the years following those in which the diseased bark was formed. In this connexion, the tendency of abnormal weather conditions or unfavourable sites to cause premature shedding of old needles and the cessation of growth in young ones before the attainment of average length must be borne in mind as a factor affecting the canker pattern.

HEPTING (G. H.) & DOWNS (A. A.). **Root and butt rot in planted White Pine at Biltmore, North Carolina.**—*J. For.*, xlii, 2, pp. 119–123, 1 fig., 1944.

Root and butt rots were observed on 75 per cent. of the 40- to 45-year-old white pine (*Pinus strobus*) in plots thinned for the fifth time in 1942 on the Biltmore Estate, North Carolina, the corresponding percentages for the trees in the thinned isolation strips, 33 ft. wide, surrounding these plots and in unthinned plots being 53 and 4, respectively. *Fomes annosus* was the principal agent of rotting, causing 29, 14, and 2 per cent., respectively, of the infections in the three above-mentioned areas, while *Polyporus circinatus* and *P. schweinitzii* were responsible for a small amount. The pathogens gained ingress through roots that had died as a result of strangling or other causes, probably associated with careless planting leading to a poor arrangement of the systems. The higher proportion of butt rot in thinned stands may be due to a build-up of *F. annosus* in the stumps of previous thinnings.

LYNCH (D. W.), DAVIS (W. C.), ROOF (L. R.), & KORSTIAN (C. R.). **Influence of nursery fungicide-fertilizer treatments on survival and growth in a southern Pine plantation.**—*J. For.*, xli, 6, pp. 411–413, 1943.

Certain chemical treatments used for the control of damping-off in seed-beds were found to exert a detrimental effect on the survival of certain species of pine in the Soil Conservation Service nursery, Chapel Hill, North Carolina. In the case of loblolly pine [*Pinus taeda*], phosphoric acid appeared to be responsible for the trouble, while shortleaf [*P. echinata*] was injured by a high concentration of either or both phosphoric acid and ferrous sulphate.

Da Rocha Azevedo (P.). **Influence of the phenols of creosote on the preservation of wood.**—*An. Ass. quím. Brasil*, ii, pp. 97–108, 1943. [Portuguese. Abs. in *Chem. Abstr.*, xxxviii, 5, p. 1087, 1944.]

Test pieces of Paraná pine (*Araucaria angustifolia*) were treated with (1) commercial creosote containing 6 per cent. phenol; (2) the same after distilling off substances boiling below 250° [C.]; (3) gas oil to which enough of the creosote distillate was added to give it a phenol concentration of 8 per cent.; and (4) gas oil, and exposed under humid conditions to the action of *Lenzites*, *Fomes*, and *Polyporus* spp. Treatments (1) and (2) afforded equally efficient protection, while (3) and (4) were unsatisfactory. It is concluded that the fungicidal effect of creosote does not reside in its tar acid content.

Ulbrich (E.). **Hausschwamm, Nassfäulen (Trockenfäulen) und andere Zerstörer unserer Häuser und Bauten. Ratgeber zur Verhütung von Pilzschäden.** [Dry rot, wet rots (dry rots), and other destroyers of our houses and buildings. A guide to the prevention of fungal damage.]—88 pp., Berlin, P. Parey, 1941. RM.2. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 11–12, p. 209, 1944.]

This publication, the first to be issued by the Mycological Department of the Botanical Museum, University of Berlin, is stated to cover in a concise and popular form, without neglecting the mycological aspects of the subject, a variety of problems connected with timber preservation against dry rot (*Merulius* [*lacrymans*] and other *M.* spp.), *Coniophora* and *Coniophorella* spp., *Poria* spp., and other wood-destroying fungi. Other sections deal with the 'blueing' of wood by Ascomycetes [including *Ceratostomella* spp.], moulds on food, household utensils, and the like, and the control of the various forms of damage.

Muntz (H. H.). **A fence post service test in the Mississippi Delta.**—*J. For.*, xli, 7, pp. 524–526, 1943.

This is a progress report on the condition in November, 1941, of 454 untreated fence posts of untreated osage orange [*Toxylon pomiferum*], black locust [*Robinia pseud-acacia*], bald cypress [*Taxodium distichum*], overcup oak [*Quercus lyrata*], honey locust [*Gleditschia triacanthos*], and red mulberry [*Morus rubra*] placed in position in the Delta Experimental Forest near Stoneville, Mississippi, in February, 1937. Osage orange was the most durable of the species examined, with all the posts still serviceable at the end of the interim period, followed in descending order by hill-grown black locust, red mulberry, Delta-grown black locust, bald cypress, honey locust, and overcup oak with 91, 89, 73, 44, 25, and 23 per cent., respectively, in a sound state. None of the creosoted posts set in the ground at the same time showed any sign of deterioration.

Romney (V. E.). **The Beet leafhopper and its control on Beets grown for seed in Arizona and New Mexico.**—*Tech. Bull. U.S. Dep. Agric.* 855, 24 pp., 8 figs., 1 map, 1943.

Beets grown for seed in the Salt River and Safford Valleys of Arizona and in Mesilla Valley, New Mexico, are subject to autumn infestations of the leafhopper, *Eutettix tenellus*, the vector of the beet curly-top virus [*R.A.M.*, xxiii, p. 159]. The insects originate principally in the adjoining semi-desert areas, where summer rains induce the germination of plants serving as hosts from July to September or later.

The variety of beet, the density of the stands, the rate at which the soil becomes covered by the foliage, and the degree of shading are important factors in determining the number of leafhoppers a planting can tolerate without sustaining appreciable injury from curly top. Observations on non-resistant varieties indicate that in Arizona, with 700 to 1,000 plants per 100 ft. of row, 125 to 150 leafhoppers per 100 ft. are necessary to inflict significant damage, such stands being able to tolerate

some 20 per cent. infection by curly top. On the other hand, an infestation of only 75 to 100 insects per 100 ft. in stands of 600 to 800 plants per 100 ft. has caused sufficient damage in New Mexico to justify insecticidal measures. In both districts a reduction in seed yield may be caused by fewer leafhoppers in thin stands than are required to induce comparable results in dense plantings. Plants sustaining severe curly-top infection by late April usually yield no seed, while the amount produced by those more mildly affected is substantially below normal. The viability of the seed from curly-top beets does not seem to be materially impaired.

Experiments covering the six-year period 1935–41 showed that important reductions in the incidence of curly top (34·2 per cent. in 1937–8, with an average seed increase of 359 lb. per acre) resulted from the control of the vector by autumn spraying with pyrethrum-in-oil at the rate of 6 to 9 gals. per acre.

Both in Arizona and New Mexico, the infestations of *E. tenellus* tend to be more injurious in or after late October. Beets planted from mid-August to early September can usually be made to cover the soil surface with foliage in about 50 days, and fields with over 95 per cent. of the ground thus covered have been found to afford unfavourable conditions for the leafhopper. The attainment of this stage by or before late October is therefore highly desirable.

TAYLOR (G. G.) & LI (L. Y.). **Ring-spot: a fungus disease of winter Lettuce.**—*N.Z.J. Agric.*, lxviii, 3, pp. 193–194, 1 fig., 1944.

Lettuce ring spot (*Marssonina panattoniana*) [*R.A.M.*, xviii, p. 569; xx, pp. 102, 191] was recorded in New Zealand in 1942. It was first identified from specimens received from Wanganui in 1939, and though not reported before, it had probably been present, though unrecognized. Incidence has increased recently, and heavy losses have been incurred in some of the older market-gardens, where lettuces are grown in close rotation. The disease is found in all the chief vegetable-growing areas, and is confined to winter lettuces. It first appears in June, becomes progressively worse up to the end of September, and then gradually dies down as warmer and drier conditions develop. Observations showed that in some Auckland crops, at least 50 per cent. of the seedlings set out in the field failed, as a result of attack, to produce marketable heads. Lettuces showing slight late infection are marketable, but rapidly deteriorate when crated, and are unsuitable for shipment.

Field evidence obtained locally suggests that the disease can be carried on the seed, as seedlings in new soil not before used for growing vegetables have become infected. That it is carried over in the soil was indicated in experiments in which healthy seedlings planted in infected soil of the previous winter showed up to 30 per cent. infection, though in these tests seedlings in soil not previously planted to lettuces remained unaffected.

In spraying tests, seedling-bed plants were given two applications of Bordeaux mixture (3–4–50), followed, in the field, by two or three sprays with cuprox (5 lb. per 100 gals.). Taking the results of six tests together, the treated plants showed 8 per cent. infection, as against 30 per cent. for the untreated. All the sprayed lettuces were saleable, but most of the unsprayed infected ones were not. In another trial, plants were taken from an unsprayed seedling-bed in which infection was present and were planted in the field. Three applications of spray were then made to half the plants. Heavy rain fell, and all the plants became infected, but the sprayed lettuces had 33 per cent. saleable plants, as against only 13 per cent. for the unsprayed.

It is recommended that spraying should be started before the disease appears in the seedling-beds. The first treatment should be applied soon after germination, and spraying should be repeated every two to three weeks in the seedling beds and every three to four weeks in the field. It is probably safe to use Bordeaux mixture throughout. A 12-months' rotation would probably be helpful. Particular care

should be taken to locate seedling-beds on soil that has not grown lettuces for at least 12 months. Half the present seeding rate would also be an improvement. Raised beds would be an advantage, especially for the later plantings. When the disease appears in the seedling-beds, the plants in the infected area should be dug out and destroyed, together with the surrounding, apparently healthy plants.

NEWHALL (A. G.). **A serious storage rot of Celery caused by the fungus Ansatospora macrospora n.gen.**—*Phytopathology*, xxxiv, 1, pp. 92–105, 3 figs., 1944.

'Black crown rot' is the name proposed for a serious storage disease of the butt ends of celery, responsible for heavy losses in western New York State and Ontario, Canada. None of the standard varieties grown for two years on muckland farms, where the trouble was prevalent, proved to be immune, though Easy Bleaching and Tall Golden Self Blanching were comparatively resistant in both seasons, while Pascal and Golden Plume were among the most severely attacked. In the first test, comprising 11 varieties, 15 to 50 per cent. of the total of 1,393 plants contracted infection in ten weeks of storage, while in the second, 9 to 65 per cent. of the plants of 15 varieties developed the rot within 11 weeks.

The first sign of infection, usually appearing seven to eight weeks after the plants have been placed in cold storage, i.e., between 25th November and 31st December, is the development of a pale ochraceous-tawny (Ridgway) lesion, 5 mm. in depth, on the butt end. With the advance of decay into the butt, the internal mycelium of the pathogen becomes strongly torose and very dark, imparting a dark olivaceous, later greenish slate-black tinge to the lesion. At a later date, the characteristic dark spots may be observed at almost any point on the outer leaf stalks, denoting inoculation through wounds. The lesions may produce conidia at room temperatures under humid conditions. The tissues near the outer edge of rapidly advancing lesions may acquire a distinct red shade.

Celery butts were successfully inoculated with pure cultures of the black crown rot fungus from tissue plantings, reisolation being effected from the lesions thus induced. Monospore cultures obtained both from naturally infected plants and from agar cultures were pathogenic to celery stalks in cold storage, seedlings grown under sterile conditions on agar, and leaves, the latter developing spots similar to those of early blight (*Cercospora apii*), on the lower surface of which sporulation occurs in a damp atmosphere.

The mycelium of the black crown rot fungus may entirely cover a 3 in. Petri dish in eight days at 18° C. on maize meal agar, indicating a growth rate three or four times in excess of those of *Phoma apiicola* or *C. apii*. The colour at three to five days varies between red, brown, and bluish-green. The cell walls thicken and the mycelium becomes torose, the individual cells being ovate to spherical, and very dark olivaceous-brown to dark bluish or olivaceous-green, and attaining a diameter of 15 to 20 or up to 30μ.

Conidia were produced in profusion by the agar inversion technique of Miss Westerdijk and Van Luijk [*R.A.M.*, iv, p. 312]. These spores which are borne singly or in groups of several on hyaline to subhyaline, uni- to tricellular conidiophores, arising singly or in clumps from the mycelium, are falcate, hyaline to subhyaline, 120 to 210 by 6 to 11 (mean 160 by 8·8)μ, nearly half the spore consisting of a tapering, whip-like beak, while a sword-shaped appendage, 90 by 2μ, protrudes from the side of the basal cell at an obtuse angle in most of the conidia. This is one of the characters differentiating the celery fungus under discussion from *C. apii*, others being the obclavate rather than acicular shape of the conidia of the former and their much greater width (twice that of the early blight pathogen). Germination may be effected from any of the cells of the black crown rot fungus, including the beak and the tip of the appendage.

The celery fungus appears to be identical with the agent of pansy (*Viola tricolor*) leaf spot described by Osterwalder from Switzerland as *C. macrospora* [ibid., iv, p. 288]. A similar leaf spot of *V. tricolor* occurs in Alaska and California, and a culture from the latter habitat proved to be identical with the celery pathogen. The parasite of caraway (*Carum carvi*) designated *Cercospora cari* by Miss Westerdijk and Van Luijk [ibid., xx, p. 191] was likewise found to be the same as *C. macrospora* and the black crown rot fungus. The latter was experimentally shown to be capable of infecting caraway and *V. tricolor*, while conversely, the Californian strain of the pansy leaf spot attacked celery. If the celery pathogen were to be retained in *Cercospora*, the name *C. macrospora* Osterw. would stand, but in a proposed monograph of the genus by C. Chupp, no place is provided for any forms having conidia with appendages. At his suggestion, therefore, the name *Ansatospora*, based on the Latin word for a handle, *ansata*, is assigned to fungi of the *Cercospora* or *Cercosporella* type the conidia of which are furnished with one or more appendages, cilia, or secondary conidia, with *A. macrospora* (Osterw.) Newhall (syn. *C. macrospora* and *C. cari*) as the type species. A technical description is given [in English only].

Inoculation experiments with *A. macrospora* on potted caraway and parsley plants resulted in small lesions on the petioles, the leaves of *V. tricolor* being similarly affected. In comparative tests with the celery black crown rot fungus and *C. apii* on apples and carrots only the former proved to be pathogenic. Recent unpublished work by Tompkins and Hansen in California confirmed the author's suspicion that many other plants serve as hosts of *A. macrospora*.

The minimum, optimum, and maximum temperatures for the growth of the celery pathogen in culture was found to be near 0°, 17°, and 31° C., respectively, and the hydrogen-ion tolerance ranged from P_H 3·35 to 7·32, with the optimum near neutrality. Circumstantial evidence was obtained of the persistence of black crown rot in the soil, and in some fields a three-year crop rotation failed to eliminate it. The results of experiments on the control of the disease by the immersion of the butt ends of freshly harvested plants in various fungicides were not encouraging, and treatment along these lines is not advocated. Since infection rarely develops until the plants have been in storage for at least seven weeks, some growers have successfully reduced the loss from *A. macrospora* by reserving suspected fields for the early crop, which is never stored. Any plants from infested locations should be carefully watched after eight to nine weeks in storage, and in case of the appearance of black crown rot should be promptly marketed to obviate loss.

PADWICK (G. W.) & BHAGWAGAR (P. R.). **Wilt of Gram in relation to date of sowing.**—*Indian J. agric. Sci.*, xiii, 3, pp. 289–290, 1 pl., 1943.

In experiments at the Imperial Agricultural Research Institute farm, Delhi, covering four seasons (1938 to 1942), gram (*Cicer arietinum*) was sown at weekly intervals from 23rd September to 28th October. The incidence of wilt [*Fusarium orthoceras* var. *ciceri*] decreased, with a corresponding increase in the grain yield, with delayed sowing [*R.A.M.*, xxii, p. 196] up to at least mid-October, after which date the harvests tended to decline. To cite some data, in 1938–9, the percentage of wilt sank from 11·5 per cent. in the 30th September sowing to 1·8 in that of 14th October, the yields for the two dates being 814 and 1,354 lb. per acre, respectively. In 1939–40 and 1940–1, the maximum yields were produced by sowings of 21st and 14th October, respectively (1,652 and 1,304 lb.), the percentage of wilt falling in the latter year from 20 in the first to 3·5 in the fourth sowing. In 1941–2 the crop was destroyed by hail, but the amount of wilt sank from 64·5 per cent. in the 30th September sowing to 10·8 and 5·0 respectively, in the plots sown on the last two dates in October.

Fischer (R.). **Zur Frage der 'Markkrankheit' (Markfäule) der Weinrebe.** [A contribution to the question of the 'pith disease' (pith rot) of the Vine.]—*Arb. biol. Anst.* (*Reichsanst.*), *Berl.*, xxiii, 4, pp. 429–456, 2 pl., 1943.

In this study the writer seeks to elucidate the causes of the so-called 'pith disease' of vines, which is very widespread in Austria, where it has been the object of exhaustive investigation, notably by Zweigelt and Voboril [*R.A.M.*, xvii, p. 499].

The symptoms of the disease, both as observed by the author and described by the Austrian workers on the one hand, and by Viala and Marsais from France on the other [ibid., xiii, p. 680], leave no doubt as to the identity of 'pith disease' and 'parasitic court-noué', alleged by the French scientists to be due to *Pumilus medullae.* The viticultural districts chiefly affected in Austria are those of Retz–Zellerndorf, Langenlois–Lengenfeld–Strass, Wolkersdorf–Mitzelbach–Matzen, and the Wachau, though no part of the country is entirely free from the trouble. Pith rot is found almost exclusively on grafts, mostly in the two- to six-year-old age group, the average loss from this source in the first year after planting amounting to 20 per cent. The Green Veltlin (highly esteemed for the excellent flavour of its wine) and Welschriesling varieties are particularly susceptible to pith disease, the latter more especially in Styria, where sporadic outbreaks are apt to occur locally. Other varieties affected to a lesser extent include the red, brown, and red-white Veltlins, Sylvaner, Gutedel, Neuburger, and the blue and grey Portuguese, *Riparia* being in general the most susceptible of the various stocks used for grafting.

From 35 diseased vines, mostly of the Green Veltlin and Welschriesling varieties grafted on *Riparia* or Kober 5 BB, the writer isolated on Pichler's agar medium (*Denkschr. Akad. Wiss. Wien* 95, 1918), adjusted to P_H 5·5 by the addition of malic acid, species of *Phoma* (20 isolations), *Oospora* (15), *Ceratostoma* (10), *Torula* (3), *Botrytis cinerea* and *Fusarium* (?) *viticola* [*F.* (?) *avenaceum*] (2 each), *Pestalotia affinis, Stysanus stemonites, Macrosporium commune* [*Pleospora herbarum*], and *Chlorosplenium* (1 each), and miscellaneous fungi (3). The predominant *Phoma* sp., representing 59 per cent. of the isolations, is characterized by coarse hyphae, up to 6μ in diameter, dark brown to nearly black at maturity, often coalescing into Viala's 'mycelial rods', 150μ in diameter; oval, often tightly compressed, applanate pycnidia, with an amber-yellow, later brown, fragile peridium; unicellular, hyaline, ovate to elongated, mostly straight, occasionally somewhat curved spores, 3 to 5 by 1·5 to 2·5μ, borne on conidiophores 10μ in length and of almost the same width as the spores; and other features typical of *Pumilus medullae,* with which the Austrian vine isolate is considered to be identical. The latter was also present in the pith of a number of healthy vines examined. The *Oospora* sp. produces a snow- to creamy-white, later reddish-brown mycelium, composed of septate, cylindrical, hyaline hyphae, 1 to 3 or up to 5μ in diameter, and spherical to oval, pale amber-yellow, thick-walled gemmae, 8 to 14μ in diameter, with a densely granular content, arising at many points along the hyphae or borne terminally in chains. The slow-growing *Ceratostoma* sp. is characterized by a brownish-grey, later clay-yellow, evanescent mycelium. Zweigelt's 'M' and 'N' fungi are tentatively identified with the author's *Oospora* and *Ceratostoma,* respectively.

The results of inoculation experiments with the three principal pith fungi (*Phoma, O.*, and *C.* spp.) are fully described and tabulated. They failed to establish the pathogenicity of the organisms, and the conclusion reached through intensive anatomical studies of the grafts (Welschriesling scions on *R. portalis* stocks, both of varying degrees of maturity) was that the trouble originates in the insufficient ripeness of both components and is at most accelerated by the presence of the pith fungi, notably under adverse soil, climatic, and meteorological conditions. The ill effects of the immature scion are mostly noticeable in the nursery, while those of the inadequately ripened stock only become apparent in the progressive deterioration of the grafts after transplanting.

It is evident from these data that the French workers' conclusions as to the parasitic nature of the form of court-noué under discussion cannot be upheld. The epidemic character of recent outbreaks is attributed to the abnormally changeable weather of recent years, coupled with the use of inferior grafting material, and need lead to no anxiety as regards a possible spread of infection.

WILLIAMS (R. O.). **Trinidad and Tobago. Administration Report of the Director of Agriculture for the year 1942.**—16 pp., 1943.

In this report [cf. *R.A.M.*, xxi, p. 10] it is stated (on pp. 4, 12, 14) that in Tobago cacao witches' broom [*Marasmius perniciosus*: ibid., xxiii, p. 169] is still not severe, and control measures are being maintained. On the Marper Estate some of the clones were still free and cropping well, while many sustained a light attack. The local trees selected for resistance, growing as budded clones and seedling blocks, reached a stage at which two were selected for the final trials. No infection was found during an inspection of the north coast of Tobago.

Bacterial wilt [*Xanthomonas solanacearum*] continues to be a limiting factor in tomato production [ibid., xix, p. 171], at least during the wetter months. Bacterial rot of cauliflower and cabbage [? *X. campestris*] was severe in some localities during the rains. In at least two widely separated localities carrots were affected by a severe leaf-spotting associated with *Macrosporium carotae*. The disease was stated to have been controlled by two applications of Bordeaux mixture made at an interval of 10 days.

Divisions of Plant Pathology and Seed Investigations.—*Rep. N.Y. St. agric. Exp. Sta., 1942–3*, pp. 34–43, 53–58, 1944.

In this report [cf. *R.A.M.*, xxii, p. 289] fermate 1½–100 is recommended for the control of apple scab [*Venturia inaequalis*]. To avoid residue, it should be used at ½ or ¾–100 with ¼ pint B1956 spreader if applied with summer oil and black leaf 155. Fermate ¼ to ½–100 is more effective than wettable sulphurs against the cedar rust fungi [*Gymnosporangium juniperi-virginianae* and *G.* spp.]. The combination of micronized sulphur 3–100 and fermate ½–100 gave excellent results in orchard practice where both scab and cedar rust were a problem. Evidence showed that sulphur sprays used against fruit diseases must, unless applied very thoroughly and shortly before rain, contain 4 to 5 lb. actual sulphur per 100 gals.

In an isolated apple orchard where elgetol ½–100 had been applied to the trees and the ground at the green-tip stage, spraying against *V. inaequalis* did not become necessary until after blossoming. Lead arsenate alone was used in the calyx and 10-day sprays against insects, and wettable sulphur was applied in the cover sprays to control secondary infection. McIntosh apples from this block were 96 per cent. free from scab at harvest, whereas in another orchard with a heavy carry-over of the fungus the fruit was less than 80 per cent. clean, though given three early sulphur sprays in addition to the cover applications.

Experimental data showed that in most seasons Bordeaux mixture (2–2–100) will control vine black rot [*Guignardia bidwellii*: cf. ibid., xxi, p. 318] and powdery mildew [*Uncinula necator*] and a concentration of 3–3–100 downy mildew [*Plasmopara viticola*]. A schedule of three applications of 4–4–100 is probably reliable for black rot and downy mildew, while two or three at 2–4–100 will control powdery mildew. Fermate (2–100) gives commercial control of downy mildew, but does not control powdery mildew satisfactorily.

Leaf spot of currants and gooseberries [*Pseudopeziza ribis* and *Mycosphaerella grossulariae*: ibid., xxii, p. 290] was controlled by two applications of Bordeaux mixture at 3–3–100 for currants and 3–5–100 for gooseberries. Lime-sulphur (1–50) did not give control. Gooseberry powdery mildew [*Sphaerotheca mors-uvae*:

loc. cit.] was controlled by one application of lime-sulphur (1–50) immediately after bloom.

For the third season in succession, spergon gave outstanding results as a pea seed protectant [ibid., xxii, pp. 290, 338], increasing yields by 100 to 900 lb. per acre in commercial fields. Arasan (1 oz. per bush.) and fermate-graphite (2·5 and 1·25 oz. per bush.) were almost as effective.

Outstanding results in the treatment of spinach seed (in the absence of red copper oxide) were secured with arasan 1 per cent., fermate 1·5 per cent., spergon 1·5 per cent., yellow cuprocide 0·5 to 0·75 per cent., and copper oxychloride-sulphate 1 per cent. The substitution of yellow cuprocide and copper oxychloride-sulphate [for red copper oxide] would effect a saving of 40 to 50 per cent. in copper without danger to the crop. In a fertile muck field where untreated seed produced a crop of 10 tons per acre, various treated lots yielded 16 to 22 tons per acre. An investment of 25 cents an acre for chemicals thus produced a return of $150 to $295 per acre.

During 1942 the severity of seed decay in Henderson Bush Lima beans [*Phaseolus lunatus*] was largely determined by soil temperature conditions. In cool, wet soils, untreated seed produced only 3 per cent. of a stand in early plantings, whereas in progressively later plantings the same stock gave 27, 52, and 86 per cent. of a stand. Seed treatments prevented much of the loss in the early plantings. Spergon (3 and 1·5 oz. per bush.), fermate (2 oz.), and arasan (1 oz.) were highly effective, ranking in the order given. In tests in commercial fields yields were increased by 100 to 1,000 lb. of shelled beans per acre. For an outlay of 10 cents per acre on chemicals, returns of $4 to $30 an acre were obtained.

Tomato leaf blight (*Macrosporium* [*Alternaria*] *solani*) [ibid., xxiii, p. 194] was controlled by four applications of copper sprays at intervals of 10 to 15 days, beginning on 17th July. The outstanding materials tested were Tennessee tribasic (4 lb. to 100 gals.), copper oxychloride-sulphate (4 lb.), and Bordeaux mixture (4–2–50). The first two were much more effective in spray than dust form. In a severely affected field, yields were increased from 8,000 to 10,000 lb. and the amount of U.S. No. 1 fruit by 20 to 30 per cent. in the later pickings. The gross receipts from spraying were $100 to $110 per acre when both yield and grade were considered.

The evidence showed that at least 9 lb. copper per acre must be used if severely infected fields are to be treated. Approximately this dosage is given by using Bordeaux mixture (2–1–50) or copper oxychloride-sulphate or Tennessee tribasic at 2 lb. per 100 gals. in four or five applications. Thorough application is necessary, and four or five nozzles per row should be used. Spraying against *A. solani* also serves to control various fruit rots. *Phytophthora infestans* occurred in a severe form in a commercial field where various copper compounds had been applied four times, and about 6 tons fruit per acre were saved. In addition, the spraying resulted in a reduction in the cost of the labour employed in harvesting, the commercial pickers, to pick a ton of fruit from the sprayed plots, taking only 21 per cent. of the time they required to pick the same amount from unsprayed plots.

In 1942 fermate (2 lb. per 100 gals.) reduced tomato infection by anthracnose (*Colletotrichum phomoides*) [ibid., xix, p. 65; xxii, p. 157] from 16·6 to 2·9 per cent. in one field, and from 32 to 1·4 per cent. in another.

In tests made in 1942 with commercial cabbage varieties resistant to yellows [*Fusarium conglutinans*: ibid., xxii, p. 291] to ascertain whether seed distributed from 1943 plantings had the required resistance, 29 different resistant strains of 12 cabbage varieties were tested in infected soil in the greenhouse, and only two fell short of requirements.

The 1942 season was marked by the most severe epidemic of hop downy mildew

[*Pseudoperonospora humuli*: ibid., xxii, p. 407] so far experienced in New York. Both this disease and powdery mildew [*Sphaerotheca humuli*: ibid., xxi, p. 246], however, were controlled, and a full crop of disease-free Late Cluster hops was produced, by treatment with Bordeaux mixture (6–4–100), zinc sulphate plus lime (6–4–100), or yellow cuprocide (1½–100). To each of these, wettable sulphur was added at the rate of 5 lb. per 100 gals. Four bi-weekly treatments, beginning in the middle of June, adequately controlled the disease when about 1,200 gals. spray per acre were used during the season, while a loss of 50 to 90 per cent. of the crop was sustained in unprotected gardens.

In spraying and dusting tests against Lima bean downy mildew [*Phytophthora phaseoli*: ibid., xxi, p. 478], the materials used included Bordeaux mixture (4–4–50), copper oxychloride sulphate, yellow cuprocide, spergon, and fermate sprays, and copper-lime (20–80), red cuprocide, yellow cuprocide, spergon, and fermate dusts. Among the sprays, Bordeaux mixture gave outstanding control, while copper oxychloride sulphate was moderately satisfactory. Yellow cuprocide at ¾ lb. per 100 gals. did not give control under the epidemic conditions prevailing. Spergon and fermate were of little value either as sprays or dusts.

The desirability of growing a second crop of potatoes for use as seed in the following season depends, under Long Island conditions, upon whether this second crop can be kept free from disease. When seed stock with a very low leaf-roll content was planted on land which had not grown potatoes that season and had a low rate of aphid infestation, second-crop Irish Cobbler potatoes were produced with field reading of only 4 per cent. leaf roll. Growers' second-crop stocks showed 22 to 50 per cent. leaf roll.

Potato seed-piece decay due to a species of *F.* was effectively reduced by treatment of the seed stock with yellow oxide of mercury (1 lb. to 30 gals. water) before cutting.

A stock of Brittle Wax bean seed was found carrying 1 per cent. infection by *C. lindemuthianum*, the first record of such fungus-seed association in hand-picked bean seed for ten years.

F. oxysporum formed sclerotia on seeds in five samples of garden and sweet peas, but no pathogenicity beyond invasion of the pods and seeds was demonstrated. Nearly half of the 160 stocks tested carried *Ascochyta pisi*-infected seeds, while *Mycosphaerella pinodes* was found less frequently. *A. pinodella* was associated with one seed stock.

A consignment of groundnut seed from a southern grower contained several lots of heavily diseased seed. When pre-germination seed treatment of these lots was neglected, accurate germination tests could not be completed. Species of *F.*, *Sclerotium*, *Alternaria*, *Curvularia*, *Basisporium*, and *Rhizoctonia* were commonly isolated. Only the *F.* species were highly pathogenic. *Rhizopus nigricans* [*R. stolonifer*] and a soft-rotting bacterium severely injured seedlings in the germinator. These fungi were controlled by new improved ceresan.

Arasan controlled moulds on most seeds, and appeared to inhibit the growth of *Diplodia zeae* in maize seed. It adhered without causing injury. It compared favourably with semesan in the control of *A.* [? *brassicae*] on cabbage seed, and greatly increased stands in soil-indexing of beans, cabbage, maize, and pea seed. By replacing the mercurials, arasan will conserve the national supply of mercury. Du Bay 1452C, with 3·2 lb. mercury in each 100 lb. dust, is as effective as new improved ceresan with 3·8 lb., or mercury chloride, with 74 lb.

Du Bay 1452C, under study as a 'bunticide' [i.e., against *Tilletia caries* and *T. foetida*], also proved to be valuable against moulds and as a seed protectant. In a study of spring grain seed treatments it caused no injury and compared favourably with new improved ceresan in increasing the emergence of barley and oats. In most cases, new improved ceresan increased the yield of oats, a dosage

of $\frac{1}{4}$ oz. per bush. being about as effective as one of $\frac{1}{2}$ oz. This also applied to barley and flax. In improving wheat stands new improved ceresan was consistently superior to other chemicals. In the control of wheat bunt arasan, leytosan, spergon, U.S.R. 604, U.S.R. 601, and Du Bay 1228E were similar to copper carbonate and new improved ceresan. Only Du Bay 1228E and U.S.R. 601 gave promising results against smuts of oats [*Ustilago avenae* and *U. kolleri*].

Botany and plant pathology section.—*Rep. Ia agric. Exp. Sta., 1942–43*, Part I, pp. 125–145, 9 figs., 1943.

This report [cf. *R.A.M.*, xxiii, p. 92] contains the following items of interest. In further breeding work by I. E. Melhus, nine watermelon varieties developed for resistance to either wilt [*Fusarium bulbigenum* var. *niveum*] or anthracnose [*Colletotrichum lagenarium*] were crossed in various combinations and selfed. Some lines are now in the F_3 generation. Two seem very promising, carrying marked resistance, good quality, and earliness.

H. C. Murphy states that the 1942 oat crown rust [*Puccinia coronata*] epidemic was one of the severest recorded. Owing to relatively lighter infection in the corn belt states, however, the reduction in total oat production for the United States was less than in 1938 or 1941. The Bond-hybrid selections showed outstanding resistance in all nurseries. The Victoria-hybrid selections were only slightly less resistant, except in nurseries where race 41 and other races virulent on Victoria appeared to be present. Thirty-three races of crown rust were identified among 147 isolates from collections made in 33 or 37 nurseries. This comparatively large number of races indicates the highest degree of specialization observed in *P. coronata*. Since annual race surveys were begun in 1927, 71 races have been identified. In 1942, races 1 and 6 were the most widespread and prevalent, as they have been since 1938. Races 41, 50, and 52, which attack Victoria, and races 45, 57, 68, and 69, which infect Bond, were identified. No race attacking both Victoria and Bond has been found in the United States. Numerous crosses are available which offer a source of combined potential resistance to all races of both rusts [*P. coronata* and *P. graminis avenae*] and both smuts [*Ustilago avenae* and *U. kolleri*] known in North America.

Halo blight [*Pseudomonas coronafaciens*] was again prevalent throughout Iowa in 1942, and caused considerable damage. Boone, Hancock, and Eihan were the most susceptible of the named varieties. Marion, Rainbow, Albion (Iowa 103), Burt, and Nakota were heavily infected. Gopher, Swedish Select, Tama, and Vicland were moderately affected. Fulghum showed outstanding resistance. Kerson, Sac, Iogold, and Iowar were moderately resistant. Selections from D69 × Bond were outstanding as a group for resistance.

A test by I. E. Melhus made to determine the amount of stem rot [*F. batatatis* and *F. hyperoxysporum*] that developed on sweet potatoes after they were set in the field indicated that all the infection came with the slips or that all field infection occurred before 15th June, when the first record was made. Five different slip disinfectants for stem-rot control were compared, using slips of the susceptible Nolte variety from the same hotbed. Fungicide 569A, an organic compound containing no mercury or other heavy metal, and used at the rate of 1 lb. in 8 gals. of water, gave 5·9 per cent. infection, as against 24 per cent. in the control; spergon came next in efficiency, with 14·8 per cent. infection. Semesan Bel definitely injured the slips and gave the lowest stand and the highest amount of disease (25·4 per cent.).

G. Semeniuk and I. E. Melhus state that in one test most of the isolates obtained from seed pieces and roots of onion seedlings showing post-emergence damping-off and stunting were *Pythium* spp. In the more advanced stages of necrosis, *Rhizoctonia* and *Fusarium* spp. were obtained from root lesions. The

Pythium cultures were identified in part as *P. debaryanum, P. irregulare, P. mamillatum*, and *P. graminicola*.

A yellowing and death of the leaves which occurred in the middle of July, 1942, on onions grown commercially on muck soil was caused by *Phytomonas alliicola* [ibid., xxi, p. 325], which was abundant in the outer scales of the young bulbs. The condition disappeared with the formation of new leaves, but at harvest time a high percentage of the bulbs showed bacterial neck rot [unspecified], which caused a loss of crop estimated at 15 to 25 per cent.

G. C. KENT and I. E. MELHUS state that in two years' tests elgetol applied as a late dormant spray to red cedars infected by cedar-apple rust [*Gymnosporangium juniperi-virginianae*: ibid., xxii, pp. 261, 289] greatly decreased spore production. An apple-scab [*Venturia inaequalis*] survey indicated that in most years the ascospores are ripe for discharge when or soon after the trees begin to leaf out. Two sprays are then necessary before blooming.

I. E. MELHUS, J. N. MARTIN, and H. C. MURPHY found that stands and yields of wheat, oats, barley, sugar beet, flax, and lucerne were greater on plots treated the previous autumn with chloropicrin against soil-inhabiting plant pathogens than they were in untreated plots. In most cases, the second stand count on the treated plots showed an increase over the first. In the case of barley, wheat, and sugar beet the yields in the treated plots were, respectively, 5, 2·4, and 1·8 times those in the untreated. Heavy applications of sodium nitrate (broadcast at the rate of 800 lb. per acre) and the same amount of complete fertilizer (6–8–12) prevented field oats from becoming stunted and chlorotic, the plants producing new roots and replacing those badly infected by *Pythium*.

G. C. KENT and I. E. MELHUS state that the cause of honeysuckle leaf blight is *Herpobasidium foliodistortum* Gould.

C. S. REDDY, E. L. WALDEE, and I. E. MELHUS state that planting potato seed pieces at a depth of 10 in. in raw alkaline peat and covering with 2 in. of the peat appeared to decrease scab (*Actinomyces scabies*), but the deep planting decreased yield. Sulphur, broadcast on alkaline peat at the rate of 1 ton per acre decreased scab severity and increased yields. The treated tubers were much superior in appearance to the untreated.

G. C. KENT, I. E. MELHUS, and A. T. ERWIN carried out preliminary studies to ascertain whether raising the water-table in peat soil would induce infection of potatoes by *A. scabies*. In two tests in cans 21 in. in diameter and holding 21 in. of soil, a water-level above 13 in. from the surface inhibited tuber formation. A constant water-level at 13 in. did not decrease yield or markedly increase scab. Periodic flooding of the peat did not appear to influence infection.

On p. 198 of this report a table is given by E. C. VOLZ showing the degree of susceptibility to black spot [*Diplocarpon rosae*] of a large number of rose varieties.

D. R. SHEPHERD and I. E. MELHUS state that during 1942, barberry eradication survey activities in Iowa extended into 31 counties, and covered 1,819 sq. m. Nine thousand and twenty-six bushes were destroyed on new and re-infested properties. Some 18 per cent. of the 636 old properties inspected were still infested. There are known areas in 36 counties totalling 3,700 sq. m. with scattered barberries that have developed from the seed of plants previously destroyed. These areas should be re-inspected before the bushes produce seed.

Pathology and mycology of Corn.—*Rep. Ia agric. exp. Sta., 1942–43*, Part II, pp. 52–57, [? 1944].

In this report [cf. *R.A.M.*, xxiii, p. 12] R. H. PORTER and W. N. RICE state (on p. 31) that during the period under review isolations from cabbage seeds in Iowa gave *Alternaria brassicae* and a bacterial vascular parasite closely resembling *Phytomonas* [*Xanthomonas*] *campestris*. This latter organism was also isolated

from radish seeds, together with a species of *Torula* causing spots on the cotyledons. *Colletotrichum glycines*, and *Fusarium* sp., *Gibberella* sp., *Phomopsis* sp., and *Alternaria* sp. were isolated from soy-bean seeds, all being associated with seed decay and some with seedling blight. Hot-water treatment of cabbage seed against black rot [*X. campestris*] was ascertained to be almost non-injurious to the seed when the temperature was controlled to within 1°, little or no damage resulting from 30 minutes' soak at 50° C. The treated seed was free from *X. campestris* and *A. brassicae*, and when dried was treated with zinc oxide to prevent decay.

E. W. Lindstrom (p. 45), describing genetic investigations of maize resistance to bacterial wilt [*X. stewarti*: ibid., xx, p. 527; xxi, p. 330], states that for a basic understanding of the nature of mutative changes in bacteria, especially virulence mutations, not only the rate of mutation, but also its relation to temperature must be known. It was ascertained that the mutation rate in a stable strain showed a good linear relation with temperature. The mutant curve of an unstable strain was found to depart significantly from any linear relation of temperature and mutation rate, which indicated a basically different nature. It is evident that the hereditary basis in bacteria does not differ significantly from that of other forms of life in point of stability.

From a single-cell culture of *X. stewarti* with medium-plus virulence 55 natural mutant colonies were selected, tested for repeatability, and stabilized. The basis of selection was colony morphology, mainly different degrees of roughness, smoothness, and colony size. With the highly susceptible inbred line GB134 as the host tester strain, these 55 mutants plus six parental bacterial cultures were tested for virulence. It was found that great variations in pathogenicity had been isolated by the mutated strains; the greater number were lower than the parental level of virulence. Only three were higher, and of these only one was significantly higher (lesion index 84, as compared with parental index of 73·8). The 55 mutant strains also differed widely in their colony morphology; in general the more virulent strains are of the smooth, sticky type. This experiment shows that mutative changes occur naturally on artificial media at room temperature. Earlier work has shown that within the living host there may be a differential selection for virulence. High virulence is favoured in resistant hosts, low virulence in susceptible ones. With mutations for increased virulence arising in host plants with a high level of resistance, there is an evident possibility of an epidemic outbreak.

I. E. Melhus and G. C. Kent state that in tests of ten commercial detergents used as surface tension depressants in the inoculation of maize with *Ustilago zeae* the best was monobutylamine oleate at 0·4 per cent. in carrot decoction. This gave a low tensiometer reading, low phytocidal and fungicidal action, and permitted a high percentage of severe infection. It had the advantage over the triethanolamine oleate, which was almost as satisfactory, of being a stable commercial product. In inoculating seedling maize the sporidial suspension in carrot decoction plus a surface-tension depressant is introduced into the space immediately under the coleoptile tip of a three- to six-day old seedling with a hypodermic syringe. This technique made it possible to determine the reaction of a maize strain 14 to 21 days after planting in the greenhouse.

In an experiment by I. E. Melhus pigs were fed with maize in which over 80 per cent. of the kernels were infected by *Diplodia zeae*, 12 per cent. by *Gibberella saubinetii* [*G. zeae*], under 2 per cent. were free from infection, and only 4 per cent. were germinable [cf. ibid., xxiii, p. 100]. They also received buttermilk and lucerne hay. After six weeks of this feeding the animals appeared healthy. The average gains per pig were 55·6 lb. for the controls fed on healthy maize, and 36 lb. for the others. The former required 6 lb. of maize to produce 1 lb. gain, and the latter 7·6 lb. No toxic effects were found in any of the carcasses. In a

second test, maize rather more highly infected with *D. zeae* was used. The average gains per pig were 196 and 156 lb. for the healthy and diseased maize, respectively, and again no evidence of toxic effect was found.

G. Semeniuk, C. S. Reddy, I. E. Melhus, E. W. Lindstrom, and G. F. Sprague state that 81 inbred lines and 49 single crosses of dent maize were inoculated in the stalks with *D. zeae* in the field in mid-August and examined in late September. Significant differences were found within each of these two groups in extent of the inoculated internode rotted by *D. zeae* and in the percentage of stalks dead from natural causes. Highly significant correlation coefficients were obtained within the group of single crosses between (1) the extent of internode rotted in 1941 and that rotted in 1942 ($r = +0{\cdot}72$), (2) the extent of the internode rotted and the percentage of stalks dead from natural causes ($r = +0{\cdot}58$), and (3) the percentage of stalks dead from natural causes in 1941 and 1942 ($r = 0{\cdot}81$). A non-significant correlation ($r = +0{\cdot}14$) was obtained within the group of inbred lines between the extent of internode rotted by *D. zeae* through artificial inoculation and the percentage of stalks dead from natural causes.

Sixteen inbred lines were transplanted to the field in the seedling stage (plumules approximately 1 in. long) after being grown in steamed sand in the laboratory from seed sprayed with a suspension of *D. zeae* spores. Premature dying of lines R4 and I198 only was noted in the autumn. Direct planting in the field in 1941 and 1942 of seed sprayed with *D. zeae* spores did not result in any premature dying of inbred lines or single crosses. Planting seed in rows in the field with a third of a teaspoonful of *D. zeae* inoculum under each seed resulted in the premature death (in 1940 and 1941) only of inbred line L289.

On 6th and 7th April, 1943, G. Semeniuk and H. J. Barre inspected in eight localities 37 steel bins each containing 3,000 bush. maize placed there in the previous autumn [ibid., xxii, p. 165]. Of these, 28 showed a mould-encrusted central apical layer of maize ranging in radius up to two-thirds of the radius of the bin and in depth from 6 in. to 2 ft. In spite of the exceptionally cold and prolonged winter, mould activity was progressing with moisture and heat liberation, chiefly through the action of *Penicillium viridicatum*, which was causing the incrustation. *Aspergillus flavus* was often found beneath this encrusted layer, and immediately below, in the non-caked and fairly dry maize, species belonging to the *A. glaucus* group occurred. Of the few fungi examined for their heat-producing capacity, *A. flavus* appeared to be the most vigorous. Marked heating of maize in bins where this fungus was present was noted in the early spring of 1943.

Barducci (T. B.). **Memoria anual de 1941 del Departamento de Genética Vegetal, Estación Experimental Agrícola de La Molina, Lima, Peru.** [Annual Report for 1941 of the Department of Plant Genetics, Agricultural Experiment Station of La Molina, Lima, Peru.]—112 pp., 47 figs., 2 diags., 74 graphs, [? 1942. Received June, 1944. English summary.]

This report contains the following items of phytopathological interest [cf. *R.A.M.*, xxi, p. 517]. The statistical analysis of the data secured in a 'Latin square' experiment designed to compare the performance of 13 selections of Tangüis cotton resistant to wilt (*Verticillium*) [*albo-atrum*: ibid., xxii, p. 166] with that of the control (Hualcará current season), revealed the significant superiority of 12 of the former, which outyielded the latter by an average of 4 gm. per plant (3·1 per cent.). The loss per annum for the country from cotton wilt may be conservatively estimated at 2,500,000 soles [£1= 26·16 soles, 1941 maximum rate of exchange]. Of two promising selections, Nos. 12–38 and 30–38, tested in a hot bed inoculated with the fungus and maintained at a temperature of 22° C., the

former yielded 11 'phenotypically immune' plants and the latter 14 for further trials.

Of 33 barley varieties tested during the period under review for their adaptability to Peruvian conditions, notably in respect of resistance to mildew (*Erysiphe graminis*), the most serious disease of the crop, the best were Chinerme, California Mariot, and Psakwon.

Rye has of late suffered extensive damage from rust [*Puccinia dispersa*], and the reactions of 34 varieties to this disease are under investigation.

A table is given showing the reactions of 3,145 selected lines, 670 varieties, and 121 mostly imported hybrids of wheat to black, brown, and yellow rusts (*P. graminis*, *P. triticina*, and *P. glumarum*) during the months of September to November, inclusive, in plots surrounded by the Mentana variety (highly susceptible to *P. graminis*). Scarcely any infection developed in September except from brown rust, which attacked the selections, varieties, and hybrids to the extent of 4·8, 5·0, and 4·1 per cent., respectively. In October, however, the incidence of black and brown rusts on the three groups amounted to 59·8, 78·2, and 85·1, and 44·5, 73·7, and 58·6 per cent., respectively, while by November the figures had risen to 100·0, 99·7, and 99·2, and 49·5, 80·6, and 63·6 per cent., respectively. The variety group was the only one to sustain more than a trace of damage from yellow rust (7·9 per cent. in both the later months). October and November are the critical months for infection by *P. graminis*, the most serious disease of wheat in the region, and on the basis of these data it is recommended that sowings of a variety resistant to *P. graminis*, e.g., 38 M.A. × San Martín 28, should be made during May or June in the Lima Valley in order to reach maturity before the critical period for infection.

White-flowered flax varieties in general, and J.W.S. and Blenda in particular, were more susceptible to rust (*Melampsora lini*) in a trial of 14 than the blue-flowered.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lv, 3, pp. 99–102, 6 figs., 1944.

Symptoms of boron deficiency in pome fruits [*R.A.M.*, xxi, p. 529; xxii, p. 140] appear as (*a*) superficial cork, (*b*) cork, (*c*) internal cork [ibid., xxi, p. 406], and (*d*) corky core. Superficial cork generally affects very small to half-grown fruit. The skin turns brown and may be dry and cracked, especially round the calyx end. Cork itself is shown externally by fruit malformation caused by the presence of irregular depressions and by raised, brown or reddish spots. In New South Wales the commonest form of the disorder is internal cork. Corky core is characterized by a general browning and death of the core, where cavities sometimes form.

Twig and foliage symptoms take the forms of incipient die-back, die-back, and rosette. In the first, the leaves on current-season twigs turn yellow during late summer and show red veins; they are rather convex or distorted. Small, brown, necrotic areas develop at the tips and margins of the leaves and in the bark tissue at the ends of the twigs, which may die from the tips downwards. Die-back, when due to boron deficiency, first appears in the spring, when buds apparently normal in all other respects fail to develop. The affected twigs die back from their tips, and an abnormal number of small branches may later develop from below the dead portion. This process may be repeated, with the production of an excessive number of small branches. Rosette takes the form of dwarfed, thickened, brittle leaves arising from nodes separated by very short internodes.

Control consists in spreading $\frac{3}{4}$ to 1 lb. borax or $\frac{1}{2}$ to $\frac{3}{4}$ lb. boric acid smoothly round fully-grown trees once every two or three years. If preferred, the borax may be applied in a spray, 1 lb. being added to 100 gals. of the lime-sulphur-lead arsenate cover spray in November. Control is helped by dressings of sheep or

stable manure at the rate of 3 to 5 tons per acre, or leguminous green crops may be sown in autumn and ploughed in during winter.

TYNER (L. E.). **Effect of media composition on the numbers of bacterial and fungal colonies developing in Petri plates.**—*Soil Sci.*, lvii, 4, pp. 271–274, 1944.

At the Dominion Laboratory of Plant Pathology, Edmonton, Alberta, the addition of boric acid to Lipman and Brown's synthetic medium (*Zbl. Bakt.*, Abt. 2, xxv, pp. 447–454, 1910) at a concentration of 1·8 gm. per l. entirely suppressed bacterial growth while permitting satisfactory development of soil fungi, similar results being obtained on potato dextrose agar with the chemical at a strength of 2·1 gm.

STAPP (C.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. XII. Mitteilung : Die Wirkung von Apfelemanation auf Erreger und Wirtspflanze.** [Crown gall and its agent *Pseudomonas tumefaciens.* Note XII: The effect of Apple emanation on agent and host.]—*Zbl. Bakt.*, Abt. 2, cvi, 8–10, pp. 167–171, 3 figs., 1943.

The gaseous emanations of three Red Autumn Calville apples with a powerful aroma exerted neither an inhibitory effect on the growth of *Pelargonium zonale* cuttings and *Datura tatula* seedlings inoculated with *Pseudomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xxii, p. 382] nor a stimulatory action on the development of the pathogen, which was promoted, however, by the high relative humidity prevailing under the bell jars. The acceleration of crown gall neoplasms observed by Nábělek under the influence of apple emanations [ibid., xviii, p. 790] must therefore be restricted to particular conditions. Moreover, not only did the aroma not impede the development of *Bact. tumefaciens* on bouillon agar, but a half apple laid directly on the medium, with the freshly cut surface downwards, actually expedited the growth of the organism.

ELROD (R. P.). **Biochemical and serological studies of the Erwineae.**—*Abstr. Doct. Diss. Ohio Univ.* 36, pp. 83–89, 1942.

Physiological differentiation within the soft-rot group of bacteria comprised by *Erwinia carotovora*, *E. aroideae*, *E. phytophthora*, and *E. solanisapra* [*R.A.M.*, xxii, p. 127] could be effected in the writer's experiments on 18 cultures of these organisms only on the basis of maltose and sorbitol fermentation. Eight of the isolates fermented maltose (maltose+), while 10 failed to do so (maltose−), the corresponding numbers for sorbitol being 7 and 11, respectively. Sera were prepared against 13 of the 18 cultures. Using 1 in 40 as the minimum dilution, cross-agglutination tests revealed 40 reactors (exclusive of the homologues) or 18·1 per cent. of the total possible (221). With the maltose− organisms in maltose sera there was 33·3 per cent. cross reaction, the corresponding figure for the maltose+ group being 28·6 per cent. The high degree of cross reaction occurring within these two groups, and the small proportion (4 per cent. of the total) outside them, were found to be statistically significant.

The cross-agglutination reactions were shown to be due to common flagellar components, of which there were at least 22 among the 18 cultures. Somatic antigens, on the other hand, were more type-specific, and similar observations were made in respect of the extracted polysaccharides.

E. amylovora and *E. tracheiphila* proved to be serologically homologous, while the few cultures available of other species outside the soft-rot group, viz., *E. salicis*, *E. lathyri*, and *E. ananas*, were likewise highly specific. The narrow host range of *E. amylovora* and *E. tracheiphila* is in contrast to the heterogeneity of the soft-rot group with their hosts in many unrelated botanical families.

Lovelock (J. E.), Lidwell (O. M.), & Raymond (W. F.). **Vaporization of lactic acid as an aerial bactericide.**—*Nature, Lond.*, cliii, 3894, p. 743, 1 fig., 1944.

After stating that effective bactericidal action by lactic acid vapour does not occur until the concentration of vapour in the air reaches 3·5 mg. per cu. m., the authors describe two forms of apparatus for the utilization of lactic acid in superheated steam. Both types have a maximum output of about 12 gm. of lactic acid vaporized per hour.

Minz (G.). **Parasitic fungi on imported straw.**—*Hassadeh*, xxiv, p. 36, 1943. [Hebrew.]

The following fungi were found on straw imported as packing material for laboratory glassware from the United States: *Urocystis tritici*, *Ustilago avenae*, and *Puccinia graminis* f. *tritici* and f. *avenae* (uredo and teleuto stages). *Urocystis tritici* has not hitherto been found on cereals in Palestine, and the other fungi may represent strains new to this country. The danger of such an introduction of infected material is evident. McAlpine (The rusts of Australia, 1906) stated that *P. graminis* spores were brought into Australia from France on wheat straw in which wine bottles were wrapped.

Minz (G.). **An experiment to control cereal rusts by dusting with sulphur.**—*Hassadeh*, xxiv, 5, pp. 183–185, 1 fig., 1944. [Hebrew.]

Wheat and oats were dusted with superfine Gaza sulphur. Florence wheat (Morocco origin) was dusted as soon as *Puccinia graminis* appeared, five treatments being given from 31st March to 2nd May, 1943. The increase of yield from sulphuring was 53 per cent. The weight of 1,000 seeds was 42·6 gm. for dusted as against 27 for diseased wheat. Mulga oats were dusted from the appearance of *P. coronifera* onwards 13 times from 14th January to 29th April, 1943, at 7- to 9-day intervals. The increased yield of 31 per cent. was not statistically significant. Wheat rusts are more readily controlled because they appear later and the period of their development is short, so that dusting in the critical period prevents rust attack. The economic value of dusting wheat will depend on improved machinery equipment and on the severity of rust attack. In this experiment relatively large amounts of sulphur were applied to insure thorough control (27 kg. for wheat and 17·5 for oats per 1/10 ha. and per treatment). In the case of oats dusting will hardly be economic, even if effective, because leaf rust sometimes appears, under favourable climatic conditions, in the very early growing stage.

Bremer (H.) & Özkan (Mediha). **The cereal rust epidemic of 1940 in Turkey.**—Reprinted from *Zir. Derg., 1941*, 8 pp., (?) 1941. [Turkish. Received July, 1944.]

The results of an examination of 162 samples of cereals received from all parts of Turkey at the Central Institute of Plant Protection, Ankara, are described and tabulated. The year 1940 was marked by a rust epidemic, particularly affecting wheat, *Puccinia graminis* being the most widely distributed species, especially in the west of the country, while *P. glumarum* was more troublesome in the east. *P. triticina* developed only sporadically along the west coast. The high incidence of infection in the west is attributed to an abnormally heavy spring and early summer rainfall, combined with a sufficient degree of heat. The weight per 1,000 grains ranged from 25 to 33 gm. compared with a normal average of over 40.

Cass Smith (W. P.) & Millington (A. J.). **Stem rust of Wheat and its control by breeding resistant varieties.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xxi, 1, pp. 1–16, 6 figs., 1944.

During 1943 an epidemic of stem rust of wheat (*Puccinia graminis tritici*), the

most serious experienced since 1934, occurred in Western Australia, causing commonly from 25 to 75 per cent. losses in yield. The wheats grown by the first Australian settlers were late-maturing English and South African varieties, which were subject to almost annual rust attacks or top-withering. Attempts were later made to select or breed rust-resistant varieties, but the problem was eventually solved by growing early-maturing varieties, which, though susceptible to rust, sustain no serious damage. Of the ten physiologic races of the rust, identified by W. C. Waterhouse in Australia, only two, 34 [*R.A.M.*, xxii, p. 95] and 43, occur in Western Australia. Race 34 was also discovered there for the first time in 1943 on the perennial grass, *Agropyron scabrum*. This discovery is taken to indicate that in Western Australia, as in New South Wales [ibid., xiv, p. 619], the fungus probably survives the summer period between wheat crops on grasses. The exact mode of the carry-over of the rust in Western Australia, however, has not yet been determined. Its survival on susceptible out-of-season cereals is believed to be unlikely in the State, where summer rains are unusual, but a carry-over on self-sown plants growing in moist places is considered possible. Weather conditions in Western Australia are stated to be seldom favourable to the development of stem rust, and a review of past years shows that epidemics have occurred infrequently (they are altogether unknown in the north-eastern wheat belt), and only in years when heavy rains had fallen between January and April, and especially in March (cf. in 1915, 1917, 1934, and 1943; also outbreaks in one district only in 1930 and 1939). Apart from the weather, disease outbreaks are associated with an abundance of rust spores on susceptible grasses and self-sown or early-sown wheat; this may become a major factor when ideal weather conditions prevail for a short time only. Important for the spread of rust is moisture accompanied by moderately cool to warm temperatures. Ideal conditions are provided during sultry weather, or when frequent light showers and heavy dews occur, especially when these are followed by a long period of cloudy weather, or when a long succession of cloudy mornings is followed by humid but not hot days.

FISCHER (G. W.) & CLAASSEN (C. E.). **Studies of stem rust (Puccinia graminis) from Poa ampla, Avena fatua, and Agropyron spicatum in the Pullman, Washington, region.**—*Phytopathology*, xxxiv, 3, pp. 301–314, 1944.

A tabulated account is given of inoculation experiments on numerous grasses and cereals with monospore cultures of *Puccinia graminis* [*R.A.M.*, xx, p. 536; xxii, p. 483] from *Avena fatua*, *Poa ampla*, and *Agropyron spicatum* collected in the neighbourhood of Pullman, Washington.

The three cultures varied widely in their host ranges, 34 species of grasses and cereals, representing 14 genera and 5 tribes, being more or less susceptible to inoculation from *P. ampla*, while the corresponding figures for the *Avena fatua* collection were 18, 9, and 3, and for that of *Agropyron spicatum* only 7, 3, and 1, respectively. The culture from *Avena fatua* was identified as physiologic race 2 of *Puccinia graminis avenae* [ibid., xvii, p. 308]. The *Poa ampla* strain appears to be a new physiologic race of *P. g. avenae*, judging by the immune reaction to it of 16 out of 17 oats varieties, including Markton and Victory, only Nortex (*A. byzantina*) being attacked. It is a virulent and polyvorous strain, restricted in the main to grasses. The *Agropyron spicatum* culture seems to be distinct from all the known forms of *P. graminis*, *P. g. secalis* being excluded by the immunity of three accessions each of *A. repens*, and rye, and *P. g. tritici* by the negative results of inoculation tests on 12 wheat varieties. In all probability a new form of *P. graminis* has been encountered with a high degree of specialization on *Elymus glaucus* and a few species of *A.* and *Sitanion*.

The uredospores of the three collections did not conform to the established biometric constants of any of the varietal complexes of *P. graminis* but they may

possibly fall within the expected range of variation for the different physiologic races of the several forms of the rust.

Jamalainen (E. A.). **Über die Wirkung von Holzrauch auf den Weizensteinbrand.** [On the effect of wood smoke on Wheat bunt.]—*Valt. Maatalousk. Julk.*, 117, 37 pp., 1942. [Finnish, with German summary. Abs. in *Chem. Zbl.*, cxiv (i), 7, p. 773, 1943.]

The results of tests at the Tikkurila (Finland) Agricultural Experiment Station showed that wheat bunt [*Tilletia caries* and *T. foetida*] cannot be effectively combated by the subjection of the seed-grain to high temperatures, while only partial success was achieved by its exposure to pine wood smoke.

Ramamoorthy (C. S.) & Mundkur (B. B.). **Neovossia indica in culture.**—*Curr. Sci.*, xiii, 2, p. 49, 1944.

In the course of a study on the germination of the chlamydospores of *Neovossia indica* (Mitra) Mundkur [the agent of Karnal bunt of wheat: *R.A.M.*, xxiii, p. 10], the slides bearing these organs were inverted over the surface of potato agar in Petri dishes and the sporidia allowed to drop on to the medium. By the end of a week at 15° C. most of the cultures had produced small, white colonies composed of thick mats of much branched mycelium and numerous secondary sporidia. The smut was successfully subcultured on potato dextrose agar and 3 per cent. malt extract solution. The powdery, brittle, crustaceous, umbonate colonies, with dendritic margins, make satisfactory though rather slow growth at 18°, the mycelium coiling in a peculiar manner, branching, rebranching, and giving rise to secondary sporidia, which are discharged explosively. Both the mycelium and secondary sporidia appear to be entirely monocaryotic.

Minz (G.). **Black point disease of Wheat.**—*Hassadeh*, xxiii, 12, pp. 348–349, 1 fig., 1943. [Hebrew.]

In Palestine the soft spring wheat varieties CCC, Giza 105, and Florence (Morocco origin) were found in 1941 to be affected by black point [*R.A.M.*, xxiii, p. 222] up to 28, 26, and 1·5 per cent., respectively. Anatomical examination of the discoloured parts of the grain revealed the presence of mycelium in the pericarp and testa. *Alternaria* sp. and *Macrosporium* sp. were isolated from cultures and fructifications (?*Pleospora*) were also found. The weight of 1,000 seeds in the affected and healthy CCC wheat amounted to 48·2 and 40·3 gm. and in the Giza 105 variety to 54·9 and 50·7 gm., respectively. This agrees with the findings of Waldron [ibid., xvi, p. 373]. The germination and sprouting of affected seeds were satisfactory.

Buddin (W.) & Garrett (S. D.). **Take-all of cereals in 1943.**—*J. Minist. Agric.*, li, 3, pp. 108–110, 1944.

Take-all (*Ophiobolus graminis*) was more prevalent than usual in England in autumn-sown wheat crops harvested in 1943. In some fields the disease appeared in May, but in most cases infection was not noticed until after the crop had headed. The outbreak was favoured by the winter of 1942–3, when double the normal amount of rain fell in January, causing leaching of soluble nitrogen from the soil, and by a prolonged hot, dry spell in June and early July, when plants with defective root systems were checked in their growth.

Infection was most frequent and most severe in wheat following wheat or barley. Field surveys showed that *O. graminis* declines under a rye grass [*Lolium perenne* and *L. multiflorum*] and clover ley to a relatively low level, but occasionally wheat may sustain appreciable loss after such ley. In some cases, severe outbreaks on wheat were traced to infection of *Agropyron repens, Holcus lanatus*, and *Agrostis* sp.

The perpetuation of the fungus on the underground parts of such grasses is probably due mainly to their perennial habit and vigorous growth. Even on the most susceptible annual grasses, such as *Alopecurus agrestis*, the life of the fungus is curtailed by the death of the host at or before the end of the growing season. Infestation of land by these perennial weeds often causes unexpected outbreaks of take-all in crops grown under otherwise excellent rotations.

ELLERTON (S.). **Reaction of Wheat varieties grown in Britain to Erysiphe.**—*Nature, Lond.*, cliii, 3895, pp. 776–777, 1944.

During May, 1944, a moderately heavy outbreak of *Erysiphe graminis* occurred in a wheat yield trial near Maldon, Essex. Attacks of less than average severity were shown by Juliana (mildew score −2·9, significance $P < 0{\cdot}01$), Iron III (−2·7, $P < 0{\cdot}01$), Wilhelmina (−2·6, $P < 0{\cdot}01$), Desprez 80 (−2·5, $P < 0{\cdot}02$), and Weibulls' Standard (−2, $P < 0{\cdot}05$), which are therefore regarded as resistant; of average severity on Victor (0) and Steadfast (0); and of more than average severity on Holdfast (+2·3, $P < 0{\cdot}05$), Little Joss (+3·3, $P < 0{\cdot}01$) and Warden (+9·3, $P < 0{\cdot}001$), which are regarded as susceptible. Other varieties tested were Als (−1·3), Gartons 60 (−0·3), Red Standard (+0·1), Wilma (+0·2), and Yeoman I (+1·5). Of other varieties tested in tests limited to six replications only Picardie showed highly significant resistance (−6·5, $P < 0{\cdot}001$), while there was some evidence that Setter, Steel, Benoist 40, Red Drottning, and Squarehead II were resistant, and Robusta, Redman, and Vilmorin 29 susceptible.

STANDEN (J. H.). **Chemical and physical characteristics of Maize cobs in relation to the growth of Nigrospora oryzae.**—*Phytopathology*, xxxiv, 3, pp. 315–323, 1944.

In a study at the Iowa Agricultural Experiment Station on the physical and chemical characteristics of maize cobs in relation to infection by *Nigrospora oryzae*, poorly-matured specimens were found to be more frequently attacked than well-matured ones. The former were less woody than the latter, and their water-absorbing capacity was greater. Poorly-matured cobs had a higher P_H than well-matured ones [cf. *R.A.M.*, xi, p. 448] and contained more water-soluble substances and available food, especially sugars, which may be lost through a delay in harvesting the ears. The fungus grows well on media containing sugars, peptone, xylan, and hemicellulose, its development on cob-meal agar being particularly luxuriant. Some water-soluble, thermostable substance or substances, apparently organic, present in abundance in poorly-matured cobs, evidently favours the growth of *N. oryzae*. A close relationship was shown to exist between susceptibility to the pathogen and the growth of the latter in response to the addition of cob extracts to the nutrient medium.

VOORHEES (R. K.). **A comparison of some copper fungicides in controlling Citrus melanose.**—*Citrus Ind.*, xxiv, 12, pp. 5–8, 14–15, 6 figs., 1943. [Abs. in *Exp. Sta. Rec.*, xc, 4, p. 495, 1944.]

The results of spraying trials carried out from 1939 to 1942 in commercial citrus groves in three localities of Florida with three up-to-date proprietary copper-containing fungicides and Bordeaux mixture for the control of melanose [*Diaporthe citri*] showed all to be about equally effective against an intensive outbreak of the disease, one application in general sufficing to confer complete protection. On the basis of these data and the outcome of Ruehle and Kuntz's experiments [*R.A.M.*, xx, p. 572], the use of 3–3–100 Bordeaux or its fungicidal equivalent in some form of neutral or basic copper has been almost exclusively adopted in the State for the object in view. To some extent certain copper materials can be

employed on the basis of equivalent metallic copper, though a wide variation in effectiveness was observed per unit of copper.

WINSTON (J. R.) & MECKSTROTH (G. R.). **Decay control in Florida Lemons.**—*Citrus Ind.*, xxv, 2, pp. 6–7, 10, 18–19, 22, 1944. [Abs. in *Chem. Abstr.*, xxxviii, 10, p. 2406, 1944.]

The ethylene treatment commonly applied to citrus fruits to improve their colour enhances the susceptibility of lemons to rapid infection by the two chief agents of stem-end rot, *Phomopsis* [*Diaporthe*] *citri* and *Diplodia natalensis* [*R.A.M.*, xxii, p. 430], spoilage by which developed at a faster rate in clipped than in pulled fruits. The decay was arrested, without damage to the rind, by immersion in 8 per cent. borax solution or sodium-ortho-phenylphenol (1·2 per cent. aqueous solution washed off at once, or up to 2 per cent. in the wax emulsion used after gassing). Withering and ageing were retarded by the wax emulsion treatment. *Diaporthe citri* was responsible for most of the rot in non-gassed lemons.

FAWCETT (H. S.) & COCHRAN (L. C.). **A method of inducing bark-shelling for treatment of certain tree diseases.**—*Phytopathology*, xxxiv, 2, pp. 240–244, 1 fig., 1944.

Of the various preparations tested at the California Citrus Experiment Station for their efficacy in the removal of psorosis-diseased bark on 5-year-old Washington Navel and Valencia orange trees, the best was dinitro-ortho-cyclohexylphenol (DNOCHP) at a concentration of approximately 1 per cent. by weight dissolved either in paraffin or medicinal-grade white mineral oil. In a few tests ordinary petrol without tetra-ethyl lead gave some indication of utility as a carrier for the chemical, but its unduly rapid evaporation in warm, dry weather is a disadvantage.

SHERBAKOFF (C. D.), MILLER (P. R.), & SIMPSON (D. M.). **Use of liquid culture of Fusarium for field inoculation of Cotton.**—*Phytopathology*, xxxiv, 2, pp. 254–256, 1944.

The following simple and inexpensive procedure has given satisfactory results in field inoculation tests to determine the varietal reaction of cotton to *Fusarium vasinfectum* at the Tennessee Agricultural Experiment Station. Hills of five seeds each were planted in Decatur silt loam soil on 22nd June, 1942, round wooden pegs, 1 by 1 by 10 in., set about 4 in. deep in the ground. On 15th July the pegs were removed and the holes thus made filled with ½-pint liquid inoculum in the form of a synthetic nutrient solution on which the fungus had been grown at 80° F. The incidence of infection among the 23 varieties or strains tested ranged from 0 in the two resistant controls, Cook 307 and Seabrook No. 10 (S.I.), to 52·5 per cent. in Trice × Tidewater (578), other highly susceptible sorts including Acala 911 (330–1–1–8), Coker 33–12 (289–3), Coker 100 (994), Stoneville 5 (62), Half and Half (control), Coker Wilds (176), and Acala 911 (330–1–8–4), with 51·9, 50, 44·4, 43·9, 41·7, 41·2, and 40·7 per cent., respectively, while among the more resistant were D.P.L. 11 (51), Coker wilt 100 (resistant control), Stoneville (37–13), Stoneville 37 × Stoneville 5, and Delfos 719 (992), with 5·7, 8·3, 12·0, 14·0, and 15·9 per cent., respectively. The performance of the control varieties in these trials closely approximated to the response expected on the basis of previous greenhouse inoculation tests and common field observations.

BOUGHEY (A. S.). **Physiological Cotton wilt in the Sudan Gezira.**—*Ann. appl. Biol.*, xxxi, 1, pp. 12–18, 1 pl., 5 graphs, 1944.

Observations made during the 1941–2 season in experiments on cotton wilt in the Gezira area of the Sudan [*R.A.M.*, xx, p. 162] indicate that between the 10th and 18th weeks after sowing, i.e., mid-October to mid-December, three factors

may cause water stress in the crop, namely, a drastic reduction in the size of the absorbing system of the plant which occurs at some time during this period and is correlated with maximum boll development, considerably increased day temperatures accompanied by higher evaporation, and a rapid decline in the amount of available water in the soil. It is suggested that a coincidence of these three factors at high intensity results in permanent wilting and death of the plants, while at lesser intensities wilting will be followed by recovery, but with reduction of yield. Support to this hypothesis was lent by experimental data on plant growth, soil water, and atmospheric conditions. It is suggested that wilt can be controlled by delaying the sowing date, using late-maturing cotton varieties, and increasing the frequency and amount of irrigation. The present disappearance of wilt from the southern and central Gezira is attributed to exactly these measures, which had been adopted for the control of black arm. The author expresses the opinion that a return to the normal early dates of sowing would lead to considerably increased losses from wilt.

KNIGHT (R. L.). **The genetics of blackarm resistance. IV. Gossypium punctatum (Sch. & Thon.) crosses.**—*J. Genet.*, xlvi, 1, pp. 1–27, 2 pl., 1944.

Further studies in the Sudan on the genetics of blackarm (*Bacterium* [*Xanthomonas*] *malvacearum*) resistance in cotton [*R.A.M.*, xx, p. 161] showed that BAR 3, a strain of *Gossypium punctatum* with grade 1 to 2 resistance (0 = immunity, 12 = full susceptibility), contains two linked blackarm-resistance genes, B_2 and B_3. B_2 is the gene responsible for resistance in the *G. hirsutum* varieties, and B_3 is a new semi-dominant factor conferring grade 7·1 to 8·1 resistance on Sakel (*G. barbadense*) when heterozygous and grade 4·1 to 7·1 when homozygous. No marked effect is exerted by any minor or modifying factors in BAR 3.

The resistance of Gambia Native is also due to B_2 and B_3, but Gambia also possesses minor factors, and crosses between it and Sakel showed blending inheritance in F_2.

Resistant and susceptible strains of Hindi Weed cotton exist. Resistant selections contained B_2 unaccompanied by weak factors. Darfur Local, a cultivated *G. punctatum* strain from the western Sudan, was heterogeneous for resistance, but gave evidence of the presence of B_3 and, it is assumed, of B_2.

EMMONS (C. W.). **Allescheria boydii and Monosporium apiospermum.**—*Mycologia*, xxxvi, 2, pp. 188–193, 1 fig., 1944.

Recent studies in Maryland showed *Allescheria boydii* [*R.A.M.*, ii, p. 226] to be the ascocarpic stage of *Monosporium* [*Scedosporium*] *apiospermum* [ibid., xix, p. 537]. Both fungi have been associated with mycetoma of the foot. A strain of *S. apiospermum* after six years in culture began to produce ascocarps identified as those of *A. boydii*. Cultures made from 150 single ascospores and 179 single conidia gave rise to colonies identical in appearance and in the production of conidia and ascospores. Single-spore cultures invariably produced colonies bearing abundant ascocarps, indicating the homothallic nature of the fungus. The conidia, which vary greatly in size (3·5 to 6 by 3 to 10μ), are borne singly at the tips or laterally on simple or branched conidiophores of greatly varying length, are elliptical, egg-shaped, or clavate, occasionally subglobose, with a truncate base and somewhat thickened brown walls. The ascocarp is initiated by a coiled ascogonium, which remains visible for some time at one side of and external to a mass of small pseudoparenchymatous cells which produce the ascocarp. The first ascocarps to develop in culture may measure up to 130μ in diameter, while those developing later or under crowded conditions may mature when only 50μ in diameter. The cleistocarpous perithecium is brown and composed of a few cell layers so thin that asci and ascospores can be seen by transmitted light through it.

The asci are at first clavate, later subglobose, with eight ascospores, which are elliptical with slightly pointed ends and faintly brown walls, and measure 4 to 4·5 by 7 to 7·5μ.

MUNIN (F.). **Molds and their occurrence in storage butter.**—*Fette u. Seifen*, xlix, pp. 605–607, 1942. [German. Abs. in *Chem. Abstr.*, xxxviii, 10, p. 2404, 1944.]

Dark-coloured moulds of the genera *Cladosporium* and *Penicillium* are stated to be very destructive to stored butter in Germany, species of the former, moreover, penetrating deeply into the substance and utilizing the oxygen, thereby increasing the spoilage. The following preventive measures are recommended: thorough treatment of wooden tanks and utensils with boiling water, chlorination, and aeration, followed by rapid drying; use of teak (preferably aged) in preference to pitch pine for dairy implements; and the utilization of a boiled salt solution in place of surface water in the process of butter manufacture.

SCHUSTER (M.). **The nature of resistance of Flax to Fusarium lini.**—*Phytopathology*, xxxiv, 3, p. 356, 1944.

In a study at the Minnesota Agricultural Experiment Station on the nature of resistance to physiologic races 6 and 11 of *Fusarium lini* in two flax varieties, Bison C.I.389, grown in soil inoculated with the former race, to which it is susceptible, yielded the fungus from the roots on the day of emergence of the seedlings, but not from the apex until a week later. Thereafter, the pathogen was present throughout the plants, all of which were wilted within 20 days. When the same variety was grown in soil inoculated with race 11, to which it is resistant, *F. lini* was isolated exclusively from the primary roots near soil-level. In Punjab C.I.20, susceptible to both races, the fungus was rife throughout the plants a day or two after emergence. Thus the resistant Bison does not actually exclude the parasite, but confines the less virulent race 11 to the root and crown tissues and retards by several days the development and spread of the more pathogenic race 6. No such inhibitory action is exerted by the susceptible Punjab, in which the fungus is rapidly disseminated through the tissues.

Partial wilting was fairly common in certain varieties included in these experiments, while in other cases plants killed to the ground gave rise to healthy new shoots. *F. lini* was isolated from segments of wilted branches on partially infected plants, but not from the green portions of the same.

FLOR (H. H.). **Relation of rust damage in seed Flax to seed size, oil content, and iodine value of oil.**—*Phytopathology*, xxxiv, 3, pp. 348–349, 1944.

Since 1939 flax rust (*Melampsora lini*) has become increasingly destructive in North Dakota, where it is estimated to have reduced the seed yield by 25 per cent. (2,000,000 bush.) in 1942. This development has necessitated the gradual replacement of the susceptible Bison by more resistant varieties. In a test to determine the effect of the disease on the seed size, oil content, and iodine number of the oil [*R.A.M.*, xxii, p. 168] obtained from a stand of Bison, significant negative correlations were established between iodine number and yield, seed size, and oil content, indicating that a reduction of the crop by rust does not lower the iodine number of the oil to the same extent as the adverse factors of drought or high temperature.

BROWN (J. G.) & BOYLE (ALICE M.). **Bacterial soft rot of Sansevieria.**—*Phytopathology*, xxxiv, 3, pp. 350–351, 1 fig., 1944.

A technical description is given of the bacterium responsible for a soft rot of *Sansevieria trifasciata* (grown for its fibre, bowstring hemp, in parts of the tropics), at the University of Arizona. Conspicuous features of the disease include chlorosis

and a water-soaked spotting of the foliage, collapse of the leaves to one side and basal rot, water-soaking and a straw-coloured discoloration of the rootstocks, and shrivelling and desiccation of the roots. The organism resembles *Erwinia carotovora*, *E. aroideae*, and *E. phytophthora* in its negative response to the Gram stain, in its aerobic nature, in the liquefaction of gelatine, reduction of nitrate, coagulation of milk and litmus milk, acid production in dextrose, *l*-arabinose, *l*-xylose, and raffinose, and with one or other of the related bacteria in various additional particulars. However, it differs from the other species, e.g., in its mobility by one or two polar flagella, failure to reduce litmus, gas production in test sugars, and cultural characteristics on potato. The agent of the soft rot is, therefore, provisionally referred to the group of intermediates between *E. carotorvora* and *E. aroideae* proposed by A. R. Stanley (*Bull. W. Va agric. Exp. Sta.* 287, 1938) [cf. *R.A.M.*, xxi, p. 325 *et passim*].

CHESTERS (C. G. C.) & HICKMAN (C. J.). **On Pythium violae n.sp. and P. oligandrum Drechsler from cultivated Viola.**—*Trans. Brit. mycol. Soc.*, xxvii, 1–2, pp. 55–62, 2 figs., 1 chart, 1944.

From 1932 to 1934, the authors examined numerous exhibition and bedding varieties of *Viola* and pansy [*V. tricolor*] from all parts of Britain affected by a soft rot of the stem near the collar or of the roots. From the diseased tissues they isolated several species of *Pythium* [cf. next abstract]. The species most frequently isolated is named *P. violae* n. sp. From diseased stems and roots of exhibition and seedling *Viola P. oligandrum* [*R.A.M.*, xxi, p. 119] was isolated, apparently a new record for Britain. In this country, the stem and root rot complex of *Viola* is due to attacks of *P.* spp., *Rhizoctonia* [*Corticium*] *solani*, and *Myrothecium roridum* [ibid., xxiii, p. 191] alone or in various combinations.

The pathogenicity of *P. violae* to *Viola* was proved by inoculation tests in pot culture in sterilized soil and potting compost and in garden beds of fresh loam. In culture on clear maize extract agar and oat extract agar the mycelium consists of intra- and extramatrical hyphae, becoming sparingly septate in old cultures. The sporangia, infrequent in host tissues and agar cultures, were spherical or subspherical, terminal or intercalary, 14 to 42 (average 26·2)μ in diameter, and germinated directly by one, less often two, germ-tubes. The terminal or intercalary, smooth, spherical, or subspherical oogonia measured 16 to 34 (average 25·7)μ in diameter. The androgynous, occasionally diclinous antheridia were, when androgynous, each supported on a brief antheridial hypha arising from the oogonial stalk immediately below, or at a short distance from, the oogonium, broadly barrel-shaped or cylindrical, slightly curved and broader than the stalk, usually contacting the basal hemisphere of the oogonium. The diclinous types were cylindrical, seldom curved. In both types, only the broad, rounded apex is applied to the oogonium, a narrow fertilization tube leading from it and piercing the oogonial wall. There are one or two antheridia to each oogonium, sometimes as many as eight. The smooth, spherical oospores, 11 to 28 (average 20·6)μ never filled the oogonial cavity. Occasionally two oospores occupied one oogonial lumen.

The most salient characters of this species are the very restricted occurrence of sporangia in host tissue and culture, the absence of swarm spore production, the dark, oily contents of the very prominent oogonia, and the abundant oospore production. Distinguishing characters from allied species are given. *P. violae* also differs from the two species of *P.* (A and B) isolated from *Viola* by Van Eek [ibid., xviii, p. 112].

The isolations referred to *P. oligandrum* show the following characters. On clear maize extract agar the intramatrical mycelium consists of primary hyphae, 2 to 6 (usually 2 to 4)μ in diameter, with lateral branches ending in tufts of short, delicate hyphae. In water culture simple or compound, terminal or intercalary

sporangia are abundant. The terminal sporangia, when simple, are spherical, measuring 10 to 28 (average 20·8)μ in diameter, or piriform, obpiriform, or oval, measuring 18 to 40 by 16 to 20 (average 24·1 by 18·1)μ, and when compound consist of two to five ovoid or highly irregular elements closely connected by cylindrical hyphal segments. Intercalary sporangia are formed on a portion of the mycelium clearly enclosed by two septa. On this the sporangia occur singly or in series as subspherical swellings 14 to 28 by 16 to 32 (average 22·5 by 23·7)μ, or as sessile, irregular lateral lobes. The diameter of the oogonia, including spines, is 24 to 34 (average 27·6μ. The spherical, smooth oospores, almost filling the oogonial lumen, measure 17 to 26 (average 21·3)μ in diameter.

Pape (H.). **Die Pythium-Wurzelfäule der Stiefmütterchen in den Vierlanden und Versuche zu ihrer Bekämpfung.** [*Pythium* root rot of Pansies in the Vierlanden and experiments on its control.]—*NachrBl. dtsch. PflSchDienst*, xxii, pp. 75–77, 5 figs., 1942. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 8–10, pp. 204–205, 1943.]

For years past the extensive pansy [*Viola tricolor*] plantings in the Vierlanden [Hamburg district] have suffered from stunting, wilting, and ultimate collapse, both seed-beds and transplanted stands being involved. The disease, said to be caused by *Pythium debaryanum*, begins with a dingy dark grey to blue-green discoloration of the leaf blades, sometimes mingled with a reddish-brown bronzing; later the foliage turns yellow or brown and shrivels, and the plants are easily pulled up from the soil, in which there is frequently only a remnant of the tap-root left. Control was effected by steam sterilization of the soil or disinfection with 1 per cent. formalin, 10 l. per sq. m.

Hawker (Lilian E.). **Notes on basal rot of Narcissus. III. Eradication of the disease from Narcissus stocks by repeated use of formalin in the hot-water bath.**—*Ann. appl. Biol.*, xxxi, 1, pp. 31–33, 1 pl., 1944.

In tests conducted at the Imperial College of Science Biological Field Station at Slough from 1939 to 1943, the amount of basal rot in stocks of *Narcissus* (varieties Bicolor Victoria, Spring Glory, Henry Irving, Glory of Leiden, and Grandis), naturally or artificially contaminated with *Fusarium bulbigenum* [*R.A.M.*, xxiii, p. 133], was reduced to negligible proportions by the addition of 0·5 per cent. formalin to the hot-water bath (usually applied against eelworm); while stocks given the hot-water bath without formalin were severely diseased. In most cases a single application of formalin was sufficient to produce these results, but one heavily infected stock had to be treated again after lifting the following season. In every case formalin treatment increased the weight and number of flowers and reduced the numbers of poor and missing plants and of bulbs rotting after lifting or in subsequent storage.

Hornback (E.). **Notes on resistance of Daffodils to virus diseases.**—*Herbertia*, ix, pp. 147–149, 1942 (published May, 1943).

In the author's nurseries in Oregon the daffodils may be grouped as follows in order of decreasing resistance to virus diseases: (1) *Narcissus tazetta* and hybrids, (2) *N. poeticus* and hybrids, (3) *N. cyclamineus* and hybrids, (4) *N. hispanicus* var. *maximus* and hybrids, (5) *N. jonquilla* hybrids, (6) old trumpet types and their hybrids, such as *N. minor*, *N. lobularis*, and *N. spurius*, (7) *N. triandrus* species and hybrids, (8) double varieties, except double *N. tazetta* hybrids and Poetaz and Poeticus varieties.

Attempts to spread the disease by mechanical means were only successful during a short period just before flowering.

McCulloch (Lucia). **A vascular disease of Gladiolus caused by Fusarium.**—*Phytopathology*, xxxiv, 3, pp. 263–287, 4 figs., 1944.

Since 1923 the writer has made observations on a destructive disease of *Gladiolus*, commonly known as yellows, wilt, or core rot [*R.A.M.*, xxiii, p. 300], and primarily involving the vascular tissues, which has spread from stock of Dutch origin grown in California, to most if not all regions of the United States where the host is grown. The causal organism, a variety of *Fusarium orthoceras*, enters the fibrous or contractile roots and corm base and advances upwards through the core, often without producing any external signs of infection until the later stages of the disease are reached, when bright, dark-brown lesions with pale reddish-brown margins appear on the corm surface. The colour of the diseased vascular tissue ranges from light to medium brown (cinnamon-buff to Saccardo's umber according to Ridgway) and its texture is fairly firm, woody, or tough. The fungus apparently develops in advance of the discoloration, since it can be isolated from externally normal vessels. A less typical condition of infected corms, variously designated as 'doughnut', 'high crown', or 'hollow core', is characterized by progressive browning, drying, and shrinkage of the core tissues from the base upwards, accompanied in extreme cases by large holes through the centre, which may destroy part or all of the root plate. A cavity of this type is usually widest at the base, tapering to $\frac{1}{4}$ to $\frac{1}{2}$ in. or more in diameter at the top, and often including and killing the terminal buds. Its brown, hard, woody wall measures $\frac{1}{2}$ to 2 mm. in thickness, the outer surface being smooth or occasionally extruding thorn-like projections into the sound, fleshy part of the corm. The entire hard, dry core is readily separable from the rest of the corm. Both the vascular and 'doughnut' type of infection originate in the field, the extent of the rot depending on the length of time between the onset of the disease and harvesting. Little or no enlargement of the cavity took place during the storage period in corms held at 5° to 10° C.

The first symptom of infection in the fibrous roots is a rusty, later dark to black discoloration, usually at the apex. The lateral roots die back, leaving a dark spot on the main root. Some of the new roots continuously arising from the root plate may escape infection: when the root plate is destroyed, roots often develop from parts above it as far as half way up the side of the corm. The diseased roots soon die, disappear, or are reduced to thin, wiry strands. Contractile roots, formed comparatively late in the season, appear to be less susceptible to vascular disease than the fibrous system. The red or red-brown streaks, $\frac{1}{2}$ to $2\frac{1}{2}$ in. long, occur mostly on the under side and are frequently overlooked; they may, however, spread and girdle the root. Dissection and staining showed the cortex to be the centre of infection, which extends in both directions and may reach the vascular tissue of the new corm.

The pathogen may be perpetuated either through diseased planting stock or infected soil. The former yields a poor crop or none, infection being transmitted directly from the parent corms to any new ones that may be formed. Healthy corms planted in contaminated soil contract the disease chiefly through the roots, or more rarely by way of the leaf bases.

The causal organism of the *Gladiolus* disease is assigned to *F. orthoceras* var. *gladioli* n.var. [a technical description of which is given in English only] on the basis of its host relationship. Experimental pathogenicity has been demonstrated in *Gladiolus* only, but a very similar species was isolated from *Montbretia* and *Tigridia* corms. The optimum temperatures for growth in culture and soil are 23° to 26° and 22° to 25°, though in soil inoculation tests infection occurred throughout the range from 15° to 32°.

In varietal reaction tests, 12 varieties proved resistant to the vascular disease,

30 moderately susceptible, and 11 highly so, the second group including Odin, a consignment of which from Holland was found to be infected in 1926.

F. orthoceras var. *gladioli* is eradicable from the soil with chloropicrin, but this method is expensive for large fields. The most promising means of control is the selection of resistant varieties, supplemented by the use of clean corms, fungicidal dips for planting stock, and planting in uninfested soil.

COLE (J. R.). **Low-lime Bordeaux mixture controls leaf gall on Azaleas.**—*Phytopathology*, xxxiv, 3, pp. 354–355, 1944.

For the past nine years Schley pecan trees in an experimental block near Albany, Georgia, have received four applications per annum of low-lime Bordeaux mixture, viz. from 10th to 23rd April, 4–1–100, and from 5th to 15th May, 1st to 15th June, and 1st to 15th July, 6–2–100, for the control of scab [*Cladosporium effusum*]. Surrounding two of the trees are nine plants of *Rhododendron obtusum*, which have incidentally been completely cured of leaf gall (*Exobasidium vaccinii*) [*R.A.M.*, xv, p. 229] and remained free from other fungal diseases, without suffering any damage from the spray though usually in full bloom at the time of the April application. On 10th May, 1943, 290 plants of *R. obtusum*, *R. macranthum*, and *R. micronulatum* infected by *E. vaccinii* were sprayed with 6–2–100 Bordeaux; a fortnight later most of the galls had shrivelled and become detached from the shrubs, and by 1st June the leaves had regained their green colour, and some new growth was in process of formation.

SMITH (K. M.) & MARKHAM (R.). **A virus disease of Lovage (Ligusticum scoticum).**—*Phytopathology*, xxxiv, 3, pp. 335–340, 2 figs., 1944.

In the summer of 1940 a fair-sized lovage (*Ligusticum scoticum*) bush in a garden in Cambridge, England, was observed to be showing typical mosaic symptoms including stunting and a bold, rather streaky foliar mottle. In inoculation experiments with the virus from tobacco, on which it induced severe necrosis, great difficulty was experienced in the infection of healthy lovage seedlings, only one out of 100 contracting the disease; on the other hand, 40 White Burley tobacco plants, 20 inoculated from lovage and 20 from tobacco, all developed systemic infection of equal intensity. Other plants successfully inoculated with the virus included Kawala Turkish tobacco, *Nicotiana glutinosa* (mild reactions), *N. sylvestris* (glassy spots, later developing a coppery ring), *N. langsdorffii*, *N. rustica*, and chilli (local lesions only in these three species), Kondine Red tomato (a symptomless carrier), *Datura stramonium* (very mild), Canadian Wonder French beans, English Wonder peas, ridge cucumber (destructive necrosis), *Lavatera trimestris* (very mild), and *Arabis hirsuta* (indeterminate symptoms). The very distinctive local lesions formed on *N. sylvestris* should fit this plant for quantitative studies on the lovage virus. Transmission is readily effected (except in the case of lovage itself) by means of sap. The virus succumbs in ten minutes to a temperature of 60° C. but withstands one of 55°. Positive infections were obtained at a dilution of 1 in 100 but not at 1 in 1,000. The virus resists a week's ageing at room temperature.

MCKAY (R.). **Scab on Pyracanthas and its control.**—*J.R. hort. Soc.*, lxix, 7, pp. 204–207, 5 figs. (between pp. xxxviii and xxxix), 1944.

From 1932 to 1936, and from 1941 to the date of writing, observations have been made on *Pyracantha* scab (*Fusicladium pirinum* var. *pyracanthae*) [*R.A.M.*, xvi, pp. 366, 515] at Glasnevin, Dublin. Symptoms of the disease, which may be responsible for severe damage and quite spoil the ornamental appearance of the shrub, include coating of the petioles with the felty, black, sooty masses of conidiophores and conidia, the latter measuring 13 to 21 by 6 to 10μ; chlorosis and shed-

ding of the affected leaves in the summer; and during the succeeding dormant season, spotting of the foliage with blackish lesions, 1 cm. in diameter, with dark red, Corinthian purple, or neutral red margins, and infection of the buds, and resulting in violent outbreaks on the new growth. In 1941 severe scab was observed on the fruit of *P. coccinea* and the current-season shoots were also defoliated while the remaining foliage was comparatively clean. On the internal surface of some of the bud scales and on the backs of young leaves in the terminal bud the fungus fructified freely, resembling apple and pear scab [*Venturia inaequalis* and *V. pirina*]. Effective control of the disease on *P. coccinea* and *P. lalandii* may be secured by spraying with lime-sulphur, at least two applications at 1 in 40 or 1 in 50 being given in the early spring, while the number of post-blossom treatments (1 in 80) should be determined by the prevailing climatic conditions.

Attempts to transmit the pathogen to apple and pear leaves gave negative results, thereby casting doubt on its supposed close relationship to *V. pirina.*

WEIMER (J. L.). **Botrytis leaf spot of Vetch.**—*Phytopathology*, xxxiv, 2, pp. 245–249, 1 fig., 1944.

A disease of vetch in Florida and Georgia caused by a fungus of the *Botrytis cinerea* group is described. The species on which the original collection was made in 1940 at Gainesville, Florida, was *Vicia angustifolia,* and since then *V. sativa* has also been found naturally infected both in Florida and Georgia; *V. grandiflora* likewise proved to be susceptible in inoculation experiments, while *V. villosa* and *V. atropurpurea* were resistant. Broad beans and lupins (*Lupinus angustifolius*) were also attacked in the artificial infection tests, and are therefore unsuitable for inclusion in a rotation designed for the control of the leaf spot, which was further induced on four strains of *V. sativa,* viz., Willamette, Selection 7, Alba, and F.C. 18808, by a form of *B. cinerea* from lupin [*R.A.M.*, xxii, p. 360]. The pathogen produces on the leaflets, stems, petioles, and tendrils of susceptible species dark red (Ridgway's oxblood), sometimes with maroon, claret-brown, mahogany-red, or chestnut borders, rarely exceeding 1 mm. in diameter on the leaflets but attaining a length of up to 1 cm. on the stems and petioles.

ULBRICH (E.). **Massenauftreten eines Myxomyceten (Mucilago spongiosa [Leysser] Morgan).** [Mass development of a Myxomycete (*Mucilago spongiosa* [Leysser] Morgan).]—*Notizbl. bot. Gart. Berl.*, xv, pp. 311–315, 1941. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 11–12, pp. 232–233, 1944.]

The Myxomycete *Mucilago spongiosa* was exceptionally widespread in the autumn of 1940 in Germany, where it damaged the second crop of meadow grasses, without, however, impairing their nutritional value, as demonstrated by tests on guinea-pigs. Other Myxomycetes assuming an injurious form at the same time included *Fuligo septica, Physarum gyrosum, P. cinereum,* and *Leocarpus fragilis.* A speedy and reliable control measure is a top-dressing of saltpetre.

SINHA (S.). **Studies in the decay of fruits in storage. I. Investigation into the causal organisms and sources of infection with a short note on the morphology of the fungi isolated. II. On the pathogenicity of certain fungi attacking Mango fruits.**—Abs. in *Proc. Indian Sci. Congr., 1943*, Part III, pp. 46–47, 1943.

In the course of studies at Lucknow on the fungal spoilage of stored fruits of mango, apple, pear, peach, pomegranate, orange, and grape, *Aspergillus niger, A. nidulans, A. fumigatus, A. tamarii, Penicillium atramentosum, P. fellutanum, Alternaria* sp. (Al 1), *Fusarium* sp. (F 1), *Rhizopus arrhizus,* and *Neocosmospora vasinfecta* were isolated from the surface. The tissues yielded 23 strains, including, besides seven identical with the superficial pathogens, *Acrothecium penniseti,*

Aspergillus candidus, *A. variicolor*, and *Colletotrichum capsici*. Mangoes, apples, oranges, and grapes in an apparently sound condition yielded a few of the organisms also occurring in the diseased tissues [cf. *R.A.M.*, xxii, p. 396], which were further isolated from the atmosphere of local storage places and mango orchards.

Infection by the fruit-rotting fungi appears to fall into two types, one taking place through wounds, lenticels, and the like, and causing immediate decay, and the other originating at an early stage in the growth of the host, but lying dormant until the maturation of the latter.

In inoculation experiments with *A. niger*, *A. nidulans*, *C. capsici*, and *Acrothecium penniseti* on two mango varieties stored at 15° and 30° C., the relative pathogenicity of the fungi was found to be influenced by the temperature and degree of maturity of the fruit, which kept well for relatively lengthy periods and sustained little damage under the cooler experimental conditions.

ANDREWS (E. A.). **The pathogenicity of a nonsporulating Basidiomycete on grasses in Minnesota.**—*Phytopathology*, xxxiv, 3, pp. 352–353, 1 fig., 1944.

Fusarium sp., *Alternaria* sp., and a non-sporulating Basidiomycete were isolated from root-rotted crested wheat-grass (*Agropyron cristatum*) at Clear Lake, Minnesota [cf. *R.A.M.*, xxii, p. 313]. The pathogenicity of the last-named organism was tested at temperatures of 65°, 75°, and 85° F. on seeds of *A. cristatum*, *Bromus inermis*, and *Festuca elatior* sown in steamed soil inoculated with maize meal-soil cultures. The most severe damage to *A. cristatum* occurred at 85°, at which temperature only 16 per cent. of the seedlings (many of which failed to emerge in all three series) survived after 22 days. The other two grasses did not sustain appreciable injury from the fungus, which appears to be restricted to the crown of the root.

The Basidiomycete produces a dense, white mycelial mat on potato dextrose agar; the hyphae range from 3 to 6 μ in diameter and are provided with prominent clamp-connexions. It grows more rapidly than the culturally divergent low-temperature Basidiomycete described by Broadfoot and Cormack from Alberta [ibid., xxi, p. 143], and further differs from *Typhula itoana* [loc. cit.] and the other *T.* spp. of Ruth Remsberg [ibid., xix, p. 434].

THORNE (D. W.) & WALLACE (A.). **Some factors affecting chlorosis on high-lime soils. I. Ferrous and ferric iron.**—*Soil Sci.*, lvii, 4, pp. 299–312, 1944.

In a comparative study at the Utah Agricultural Experiment Station of soil samples from areas producing (*a*) chlorotic and (*b*) green plants, those of the latter series were found to contain significantly more readily reducible iron and manganese than the former. Ferrous and ferric iron salts added to either type of soil were rapidly immobilized. Chlorotic Elberta peach, Bartlett pears, Jonathan apple, Concord grape [*R.A.M.*, xx, p. 557], and prune leaves contained more potassium and nitrogen and less iron and calcium than did green ones, the average iron content of the five kinds of fruit in the diseased and healthy groups being 115 and 132·4 p.p.m., respectively, and that of calcium 1·40 and 1·81 per cent., respectively. The iron content of peach and pear fruits from green trees appreciably exceeded that of those from chlorotic individuals (36·5 and 24·1 mg. per kg. green weight for peaches from healthy and diseased trees, respectively, and 21·8 and 14·8 mg., respectively, for pears). Hydrochloric, acetic, and formic acid solutions each extracted substantially more ferrous iron from green than from chlorotic foliage, while ferric iron was more readily reduced by green than by chlorotic leaf extracts and sap. The soil and plant conditions associated with chlorosis are thus evidently conducive to the maintenance of iron in insoluble ferric compounds.

ZOBRIST (L.), CONRAD (R.), & ZOGG (H.). **Untersuchungen über die Gloeosporium-Fruchtfäule an Kirschen.** [Investigations on the *Gloeosporium* fruit rot of Cherries.]—*Schweiz. Z. Obst-u. Weinb.*, liii, 8, pp. 145–151; 9, pp. 161–169, 8 figs., 1944.

Since 1939 the fruit rot of cherries caused by *Gloeosporium fructigenum* [*Glomerella cingulata*], hitherto of minor importance in Switzerland, has assumed a virulent form in parts of the canton of Thurgau, where entire orchards have been attacked; reports of its occurrence have also been received from the cantons of Basle and Aargau and isolated localities in those of Berne and Zürich. The Frühe Luxburger variety is the most susceptible, while Späte Basler and other hard-fleshed types are comparatively resistant. In inoculation experiments with spore suspensions of the fungus both wounded and unwounded fruits contracted infection. In 1942 and 1943 the disease broke out between 18th and 24th June, the first lesions being observed near the pedicel insertions on cherries in large, leaf-covered bunches. Diseased fruits shrivel and remain hanging on the trees in the form of mummies until the winter, when they gradually drop off, leaving the pedicels clustering on the shoots until the emergence of the new growth. Bud development in their vicinity is inhibited, and only one or two flowers are formed. In severe cases 40 to 60 per cent. of the dessert crop may be lost, the rotted fruits being fit only for distillation into cherry brandy. Attempts to combat the disease by the lime-sulphur sprays applied against shot hole [*Clasterosporium carpophilum*] were unsuccessful, while the special copper treatments given shortly before the harvest in 1942 also failed to prevent the decay of the fruits. In the following year the disease was effectively controlled by two post-blossom applications, between mid-May and mid-June, of lime-sulphur with the admixture of 0·5 per cent. virikupfer [copper oxychloride], but further experiments are necessary before a definite schedule of treatments can be laid down.

Mention is further made of three other pathogens affecting Swiss cherry orchards, namely, *Penicillium glaucum*, *Sclerotinia fructigena*, and the undetermined bacterial agent of grease spot [*R.A.M.*, xxi, p. 495].

HILDEBRAND (E. M.). **Mature Peach fruit affected by leaf curl.**—*Phytopathology*, xxxiv, 3, pp. 345–347, 1 fig., 1944.

Taphrina deformans, though common on young or semi-mature peaches in New York and elsewhere in the United States, has seldom been recorded on the ripe fruit. In September 1943, however, reddish lesions, covering $\frac{1}{8}$ to $\frac{3}{4}$ of the surface, were observed on Elberta peaches in an orchard in Niagara County, where the disease had not been effectively combated owing to the use of a deteriorated sulphur fungicide. Although the fungus usually attacked less than 5 per cent. of the fruits on a tree, an economic loss was sustained as a result of the ruling prices of $6.00 and upwards per bush. Attempts to demonstrate the presence of the pathogen in the lesions were unsuccessful, their negative outcome being in line with G. H. Cunningham's observation on nectarines in New Zealand [*R.A.M.*, ii, p. 373] to the effect that fructifications rarely develop in this type of infection.

HANSEN (H. N.) & RAWLINS (T. E.). **Cercospora fruit and leaf spot of Olive.**—*Phytopathology*, xxxiv, 2, pp. 257–259, 1 fig., 1944.

A species of *Cercospora* closely resembling *C. cladosporioides*, reported by Saccardo on olive leaves in Italy [*R.A.M.*, xviii, p. 604] and Algeria, has been isolated from purple-spotted, green fruits of the same host in California. The pathogen grows very slowly in culture, producing small, pycnidium-like structures containing minute, unicellular spores, possibly spermatia, attempts at the germination of which were unsuccessful, and later multiseptate conidia. The latter have also been observed on the discoloured spots on over-ripe fruits and growing out of the

stomata on the under sides of the leaves, which may be prematurely shed. Olives intended for pickling in the green stage had to be discarded on account of the spotting, which persists on the processed product, causing appreciable losses to the trade, but ripe fruits may be treated in the ordinary way notwithstanding the disease, since they undergo no deterioration of appearance or flavour, and are not injurious to health.

Report on the Department of Agriculture, St. Lucia, 1942.—14 pp., 1943.

In this report [cf. *R.A.M.*, xix, p. 717], it is stated (on p. 4) that there are probably fewer than 500 acres now cultivated to bananas in St. Lucia, and many of these are in a semi-abandoned condition. There was a very considerable increase in Panama disease (*Fusarium* [*oxysporum* var.] *cubense*) in both old (over three years) and new fields.

APPEL (O.), Ed. **Sorauer (P.). Handbuch der Pflanzenkrankheiten. Pflanzenschutz. Verhütung und Bekämpfung der Pflanzenkrankheiten.** [Sorauer (P.). Handbook of plant diseases. Plant protection. Prevention and control of plant diseases.]—viii+732 pp., 184 figs., Berlin, P. Parey, 1941. [Abs. in *Rev. appl. Ent.*, Ser. A, xxxii, 6, p. 188, 1944.]

This second half of the sixth (final) volume of Sorauer's well-known text-book on plant diseases [cf. *R.A.M.*, xvi, p. 478] contains the subsection on biological control (pp. 1–120) and six further main sections. The first five of these comprise discussions by various authors on the equipment used in plant protection work (pp. 121–303), the methods and criteria employed for the determination of the soundness or otherwise of seeds or other planting material and the purity of resistant plant strains (pp. 304–361), the cultivation and breeding of pest- and disease-resistant varieties (pp. 362–406), the legislation in force against pests and diseases of cultivated plants in Germany and, more briefly, elsewhere (pp. 407–583), and the history and functions of the official bodies concerned with plant protection work in Germany and (less fully) other countries (pp. 584–632). The concluding section (pp. 633–664) contains lists of the principal monographs, journals, and serial and occasional publications in many languages dealing with different aspects of plant protection. An index to the whole of Volume VI is appended.

MORSTATT (H.). **Beiträge zur Wirtschaftsgeschichte tropischer Kulturpflanzen und ihrer Krankheiten. I. Der Parakautschuk. II. Der Kaffee.** [Contributions to the economic history of tropical cultivated plants and their diseases. I. Pará Rubber. II. Coffee.]—*Kolon. Rdsch.*, xxxiv, pp. 14–22, 79–88, 1943. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 11–12, pp. 209–210, 1944.]

The author's object in this series of papers is to emphasize a hitherto largely neglected aspect of the cultivation of tropical crops, namely, the influence of diseases and pests of such crops on the collective economy of the affected regions and hence on world market statistics. The history of the successful development of *Hevea* rubber in the Far East and the devastating effects produced by coffee rust (*Hemileia vastatrix*) in Ceylon and elsewhere in the eastern tropics, are discussed.

MORSTATT (H.). **Krankheiten und tierische Schädlinge der Nutzpflanzen Afrikas.** [Diseases and animal pests of the economic plants of Africa.]—Reprinted from 'Afrika', viii, 147 pp., 56 figs., Berlin, W. de Gruyter & Co., 1942. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 8–10, pp. 202–203, 1943.]

Following an introductory survey of the main problems of plant protection in the African colonies [cf. preceding abstract], the writer discusses the diseases and pests of the individual fibre-, oil-, tannin-, rubber-, food-, condiment-, spice-,

and drug-yielding plants in relation to cultural and environmental factors, control, and economic importance.

Botanical investigations at Rothamsted.—*Proc. Linn. Soc. Lond.*, clv, 3, pp. 236–244, 1944.

In this symposium of the botanical investigations carried on at Rothamsted since the inception of the Experimental Station in 1843 are the following contributions: Minor elements and plant growth, by W[INIFRED] E. BRENCHLEY (already noticed from another source [*R.A.M.*, xxiii, p. 78]); and The nature of plant viruses, by F. C. BAWDEN, briefly reviewing some outstanding discoveries regarding the attributes of these 'obligately parasitic pathogens, too small to be resolved by ordinary microscopical methods', since scientific study on tobacco mosaic was inaugurated by Ivanowski in 1892.

Manual of extension methods in plant pathology.—*Ext. Serv. Circ. U.S. Dep. Agric.* 411, 37 pp., 1943. [Mimeographed.]

This manual, prepared as a contribution of the Extension Subcommittee, War Committee, of the American Phytopathological Society, presents valuable information on extension methods for plant pathologists and should greatly assist them in the work of advising and training farmers for plant disease control. Well-known State and Federal plant pathologists have contributed chapters, drawing largely on their own experiences. Among others, R. J. Haskell outlines the scope of work of an extension plant pathologist and discusses the personal qualifications required; O. D. Burke writes about the 'method demonstration' as a teaching device; M. F. Barrus advises on the teaching of farmers by means of organized meetings and conducted tours; C. T. Gregory stresses the importance of press and radio in spreading information on plant diseases; and O. C. Boyd deals with the methods of conducting disease surveys.

FLEMING (A.) & SMITH (G.). **Some methods for the study of moulds.**—*Trans. Brit. mycol. Soc.*, xxvii, 1–2, pp. 13–19, 1944.

Excellent preparations of mould colonies can be obtained and preserved by cutting out disks of paper or cellophane, sterilizing them in an autoclave, placing them on the culture medium in a Petri dish, and then inoculating them in the centre. When the resultant colony has reached the desired size, the disk can be removed, exposed to formalin vapour, dried, and then mounted on a card or glass and protected with a glass covering. A flat spectacle lens blank, covered with a curved spectacle lens blank, may also be used in mounting. An additional advantage of cellophane disks is that, with some moulds, the colony floats off when the disk is placed on water or 10 per cent. formalin and can be transferred to a glass mount.

In observations of spore germination, small cellophane squares or disks were placed on a solid medium and mould spores planted on the surface of the cellophane. When growth had taken place for a sufficient time, a cellophane slip was removed and mounted in 10 per cent. nigrosin (containing formalin). For immediate examination the cellophane serves as a cover-slip, and the germinated spores stand out clearly on a dark field. For permanent record a slip with nigrosin added and dried may be mounted in Canada balsam.

For positive staining of recently germinated spores the best results are with lactophenol-picro-nigrosin, the preparation being sealed with Noyer's cement or any other suitable material. The cellophane strip may be stained with lactophenol-picro-nigrosin in a watch glass and mounted in lactophenol or de-stained in water, then carried through two changes of alcohol and mounted in Gurr's mounting

fluid. With older cultures with fruiting bodies the best results are given by lactophenol-picro-nigrosin staining, following by mounting in lactophenol.

For mounting moulds the most satisfactory medium for general use is lactophenol. Picro-nigrosin in lactophenol stains quickly and clearly, and the stain is not removed by replacement with plain lactophenol or treatment with alcohol or strongly acid reagents. The paper concludes with directions for sealing lactophenol mounts.

Fancutt (F.) & Twiselton (M. S. J.). **A method for determining mixtures of shirlan and *p*-nitrophenol in rot-proofed Cotton.**—*J. Soc. chem. Ind., Lond.*, lxii, 11, pp. 205–206, 1943.

Details are given of a method for determining the quantities of shirlan NA [*R.A.M.*, xxii, p. 136] and para-nitrophenol in cotton fabrics and the like, used in the manufacture of railway waggon sheets, which have been treated against rotting with mixtures of these two substances. Both are estimated colorimetrically by employing the indophenol reaction which occurs between shirlan and dimethyl-para-phenylenediamine and between para-aminophenol and ortho-cresol, respectively.

Bose (S. R.). **Suspected symbiosis in Casuarina equisetifolia tree.**—Abs. in *Proc. Indian Sci. Congr., 1943*, Part III, p. 45, 1943.

A fungus of weak virulence, believed to be an Ascomycete, has been found occupying the cells of roots, stems, green branchlets, cones, and seed coats of healthy *Casuarina equisetifolia* trees in different parts of Bengal and Bihar and Orissa. On the germination of the seeds, the hyphae in the coat infect the seedlings and normal development takes place without the intervention of ecto- or ectendotrophic mycorrhiza. A close connexion has been established between the presence of tannin in the vicinity and hyphal formation in the trees. Ordinarily a state of well-balanced equilibrium appears to exist between host and fungus, but sometimes the latter assumes a virulent form and may kill the tree. Experiments on the germination of *C. equisetifolia* seeds in pure cultures of the fungus are in progress.

Noecker (N. L.) & Reed (M.). **Observations on the vitamin requirements of Stereum frustulosum (Pers.) Fr.**—*Amer. Midl. Nat.*, xxx, 1, pp. 171–174, 1943.

Studies on the vitamin nutrition of *Stereum frustulosum* showed that of thiamin, riboflavin, pyridoxin, and biotin only the first-named was of benefit to the fungus. It was as effective as yeast extract, its optimal dosage being 0·5 gamma per 25 ml. of culture medium. Thiazole was as effective as the whole molecule of thiamin. Small amounts of washed agar had a beneficial effect, this action being, presumably, physico-chemical.

Saksena (R. K.) & Bhargava (K. S.). **Nitrogen requirements and vitamin deficiencies of Phytophthora phaseoli Thaxter.**—*Proc. Indian Acad. Sci.*, xviii, 2, pp. 45–51, 1 fig., 1943.

In the writer's experiments at the University of Allahabad, a culture of *Phytophthora phaseoli* from the Centraalbureau voor Schimmelcultures, Baarn, Holland, made no growth on a medium consisting of mineral salts, dextrose, and inorganic nitrogen, but required a special amino acid (*d*-alanine), supplemented by thiamin. Other substances providing nitrogen in a suitable form included peptone, hydrolysed peptone, casein, buttermilk, lentil and yeast extracts, and Lima bean [*Phaseolus lunatus*] infusion, all of which, except casein, also supply the necessary growth substance.

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MARCZYNZSKI (R.). **Studies on the nutrition of Collybia velutipes (Curt.) Quél. (Homobasidiomycetes, Agaricales).**—*Amer. Midl. Nat.*, xxx, 1, pp. 164–170, 1 graph, 1943.

In a study of the vitamin requirements of *Collybia velutipes*, a fungus causally related to heartwood decay in tree stumps and living trees, the strain used had been isolated from a sporophore from an elm stump in Indiana. The results showed that the addition of thiamin to the medium increased dry matter production by 400 per cent. Thiazole was as effective as thiamin, but pyrimidin was less active. Biotin was only slightly active at a small dosage (0·1 gamma per 26 ml. of medium), but highly effective at a large one (5 gammas per 26 ml. of medium). Pyridoxin and riboflavin were ineffective. Yeast and malt extract were more active in small quantities (5 mg. per 26 ml. of medium) than was a combination of thiamin, biotin, pyridoxin, and riboflavin. This indicates the presence in the extracts of some factor or factors other than the vitamins studied. Small amounts of bacto-agar increased the production of dry matter, possibly because of its physical properties.

LECLERG (E. L.), LOMBARD (P. M.), EDDINS (A. H.), COOK (H. T.), & CAMPBELL (J. C.). **Effect of different amounts of spindle tuber and leaf roll on yields of Irish Potatoes.**—*Amer. Potato J.*, xxi, 3, pp. 60–71, 3 figs., 1944.

Experiments conducted over a period of three to four years, between 1939 and 1942, in Alabama, Florida, Louisiana, Maine, Maryland, New Jersey, and Virginia, showed a general tendency for potato yields to decrease progressively as the amounts of either spindle tuber or leaf roll increased [*R.A.M.*, xxiii, p. 75]. The reduction in yield in the presence of 4 or even 8 per cent. spindle tuber (amounting on the average to 2·6 and 3·7 per cent., respectively), or 4 or 8 per cent. leaf roll (3·2 and 4·4 per cent.) was not usually significant from the point of view of commercial growing. It is pointed out, however, that under favourable conditions for current-season infection the market quality of a crop with 4 per cent. leaf roll can be severely affected by net necrosis in both the Green Mountain and Irish Cobbler varieties. The point of significant reduction in yield was found to be between 32 and 100 per cent. infection for either disease, although the effect on yield of either varied considerably in different seasons and for different varieties. In the presence of 100 per cent. spindle tuber, no significant difference in yield reduction was evident between Katahdin, Irish Cobbler, and Green Mountain, but it was significantly greater with both Katahdin and Triumph in Louisiana than it was in Maine during 1941 and 1942. The reduction in yield due to 100 per cent. leaf roll was, for Irish Cobbler, greater in Maine and Virginia during two years than in New Jersey, and for Katahdin greater in Florida and Maine during three years than in Louisiana. At the 100 per cent. disease level, leaf roll was more serious on Katahdin in Maine than was spindle tuber, whereas both diseases were equally detrimental to Irish Cobbler. Spindle tuber was more serious on Irish Cobbler in New Jersey and Virginia than was leaf roll, and the percentage reduction in

yield caused by leaf roll was significantly greater than that resulting from spindle tuber on Katahdin in Florida, Louisiana, and Maine from 1940 to 1942, inclusive.

SILBERSCHMIDT (K.), KRAMER (M.), et AL. **A influencia da altitude sobre a degenerescencia da Batatinha no Estado de São Paulo.** [The influence of altitude on Potato degeneration in the State of São Paulo.]—*Rev. Agric. Piracicaba*, xviii, 1–2, pp. 1–108, 9 figs., 1943. [English summary. Abs. in *Exp. Sta. Rec.*, xc, 4, p. 490, 1944.]

Records were kept of the environmental conditions, yields, general state of health, and progressive development of virus diseases in seven consecutive 'generations' of the progenies of 300 healthy Eigenheimer potato tubers, one half of each of which was planted in a mountainous region (Cascata) of São Paulo, Brazil, and the other in the plains. Some of the offspring were transferred backwards and forwards between the mountains and the lowlands, while other lots were grown continuously under uniform conditions. Tuber lines returned to the mountains after temporary cultivation in the plains were found to have suffered a serious decline in fertility as compared with those grown continuously at a high elevation. Conversely, after one season in the mountains, tuber lines brought back to the low-lying regions yielded heavier crops in the next 'generation' than those that had remained in the plains, but the advantage was not maintained. Cultivation at a high altitude would thus appear to be beneficial for seed production purposes, especially in warm countries [*R.A.M.*, xix, p. 234].

SARDIÑA (J. R.). **La degeneración de las Patatas.** [Potato degeneration.]—*Agricultura, Madr.*, xiii, 142, pp. 83–87, 5 figs., 1944.

Brief descriptions, accompanied by a key, are given of the virus diseases affecting potatoes in Spain, namely, leaf roll (the most serious), 'mosaico superbenigno' (potato virus A), 'mosaica simple' or 'común' (potato virus X), and 'mosaico rugoso' [crinkle] (generally potato viruses A+X), together with directions for their control by the use of healthy, certified seed and field sanitation, involving roguing and tuber-indexing.

BENLLOCH (M.). **Enfermedades de las variedades importadas. La 'hipocnosis' o 'viruela' de la Patata.** [Diseases of imported varieties. 'Hypochnosis' or 'pox' of the Potato.]—*Agricultura, Madr.*, xiii, 2, pp. 78–82, 5 figs. (1 col.), 1944.

In 76 out of a large number of potato samples from different consignments examined between 1940 and 1943 at the Madrid Station of Phytopathology the presence of *Corticium vagum* (*Rhizoctonia solani*) [*C. solani*] was detected, distributed as follows among the imported varieties: Erdgold 19, Ackersegen 11, Flava, Wekaragis, Ostbote, and Ragis 6·002, 7 each, Konsuragis 5, Sabina 4, Merkur 2, and Ragis blanca, Ragis (?), Frühbote, Mittelfrühe, Condor, Akebia, and Royal Kidney (Finisterre), 1 each. In relation to the large volume of imports, the proportion of infection is very small, but there is a risk that the pathogen may be introduced by means of contaminated seed tubers into regions hitherto free from its ravages. For instance, outside Galicia, only one case is on record from the province of Palencia (1936), while in 1943 the writer detected the disease in the first-year progeny of Erdgold at La Cepeda, León. *R. violacea* [*Helicobasidium purpureum*], the imperfect stage of which closely resembles that of *C. solani*, is widespread on beet and lucerne in various parts of Spain. Directions are given for the control of *C. solani* by a rational system of cultivation and immersion of the tubers, before planting, in an acidulated mercuric chloride solution.

Other diseases of imported potatoes in 1942 included *Alternaria solani* on the Konsuragis variety at Montroig (Tarragona).

SCHLEUSENER. **Was lehren uns die Kartoffelkrankheiten des Jahres 1943?** [What do the Potato diseases of the year 1943 teach us?]—*Mitt. Landw., Berl.*, lix, 7, pp. 141–143, 1944.

The writer describes some of his experiences in connexion with the inspection of seed potato-producing establishments in East Prussia, where leaf roll was the most important of the virus diseases in 1943. There has been a growing tendency, for the last ten years or so, to concentrate on the viruses at the expense of other equally important groups of pathogens, notably the foot-rotting *Rhizoctonia* [*Corticium*] *solani*, which is promoted by the high temperatures prevailing in the storage house in the spring following mild winters such as those of 1942–3 and 1943–4. It is particularly important to maintain a cool atmosphere during the last two months before planting, so that the tubers do not lose their vigour through premature germination. One of the best methods of combating *C. solani* is to enrich the soil with green manure by the inclusion of lupins in the rotation, immediately preceding the potato crop.

THURSTON (H. W.). **Recent tests of materials for Potato spraying in Pennsylvania.**—*Amer. Potato J.*, xxi, 3, pp. 55–59, 1944.

Among about 20 spray materials tested from 1941 to 1943 on the experimental farms of the Pennsylvania State College, all applied at the rate of 125 gals. per acre per application, only yellow cuprocide and tribasic copper sulphate [*R.A.M.*, xxiii, p. 74] gave potato yields not significantly lower than those obtained after spraying with Bordeaux mixture of comparable copper content. The copper 'A' compound (copper oxychloride) [loc. cit.] and the organic material HE 175 (disodium ethylene bisdithiocarbamate) showed some promise, but so far no material has been found better than Bordeaux. Reduced amounts of copper in spray formulas failed to give satisfactory control during severe outbreaks of late blight [*Phytophthora infestans*: loc. cit.] and led to significantly poorer yields.

DILLON WESTON (W. A. R.) & TAYLOR (R. E.). **Blight.**—*J. Minist. Agric.*, li, 3, pp. 111–116, 1 fig., 1944.

In this practical discussion of the control of potato blight (*Phytophthora infestans*) with special reference to war conditions, the authors emphasize the danger of leaving diseased tubers lying about when the clamps are opened. When a clamp is opened, diseased tubers should be fed to pigs, burnt, or buried, and as soon as possible the clamp site should be ploughed, and a catch crop taken. Wherever possible seed should be boxed and periodically examined for the presence of blight. Earthing-up is important—a good ridge that reduces the risk of greening to a minimum also reduces blight. In industrial areas, spraying and dusting may do more harm than good, as interaction may occur between the material used and the acid fumes present in the atmosphere. Before undertaking spraying or dusting within twelve miles of a large industrial centre, expert advice on the advisability of treatment should always be obtained.

The severity of the disease annually from 1939 to 1943 is briefly noted. In 1940, wastage in clamped tubers in East Anglia consisted primarily of dry rot [*Fusarium caeruleum*], blight being found in clamps only in coastal areas of Lincolnshire. In 1941, wastage in tubers was heavy, especially round the Wash and in northern localities, where a 50 per cent. loss was commonly reported, but dry rot was not common. In 1942, wastage of tubers due to blight was conspicuously less than in 1941, averaging just over 3 per cent. in clamps in the eastern counties. The premature death of the haulm in 1942 accounts for the reduced tuber infection at lifting.

Marchionatto (J. B.). **El 'manchado' do los granos de Arroz y los hongos que lo acompañan.** [The 'spotting' of Rice grains and the fungi that accompany it.]—*Rev. argent. Agron.*, x, 2, pp. 114–116, 1 pl., 1943. [English summary.]

The examination of rice grains bearing brown, chestnut-brown, dark, or whitish spots on the husks revealed the presence of various fungi, among which a species of *Alternaria* and a *Curvularia* placed by E. C. Tullis in close proximity to *C. pallescens* Boedijn [*R.A.M.*, xiii, p. 475] predominated, while others included species of *Helminthosporium*, *Epicoccum*, *Fusarium*, *Brachysporium*, and *Phoma*.

C. pallescens grows readily in pure culture on 1 per cent. potato dextrose agar, forming greenish colonies which spread outwards in a radial direction, the surface ultimately becoming covered by the cottony, appressed mycelium. The solitary, septate, prostrate conidiophores measure 110 to 130 by 3 to 4 μ, the hyaline, slender basal portion turning brown and increasing in diameter towards the slightly curved upper extremity, and give rise to acropleurogenous, ellipsoid, straight, geniculate conidia, 24 to 30 by 7 to 10 μ, consisting of four cells of irregular size and shape, the top and bottom hyaline and the middle ones greyish. Inoculation tests with spore suspensions of the fungus on sterilized Blue Rose rice grains in nutrient tubes at 18° to 22° C. resulted in the appearance, in 10 to 14 days, of brown, necrotic spots on the seedling roots, followed by cessation of growth and chlorosis and death of the leaves. Some of the infected grains failed to germinate, and on these were produced cylindrical, black sclerotia, $\frac{1}{2}$ to 1 by $\frac{1}{2}$ to $\frac{3}{4}$ mm., which did not develop on any of the culture media used but were subsequently observed in nature on non-viable, spotted grains. The sclerotia were attached at their bases to the teguments of the grain and consisted of polygonal, hyaline interior hyphae, while those of the exterior were greyish to dark, with irregularly papillate surfaces, and extended into sterile or fertile structures, the latter bearing conidia. The sclerotia of *C. pallescens* resemble those of *C. lunata*.

Negative results were given by inoculation tests with the *Alternaria* as regards actual pathogenicity to the seedlings, but there is reason to believe that it is concerned in a saprophytic capacity in the 'blanching' of the spikelets frequently following infection by *Piricularia oryzae*.

Ryjkoff (V. L.). **Желтуха Кок-сагыза.** [Kok-saghyz yellows.]—*C. R. Acad. Sci. U.R.S.S.*, N.S., xli, 2, pp. 94–96, 1 fig., 1943.

The author reports a new disease of kok-saghyz [*Taraxacum kok-saghyz*] in the Bashkir Republic and elsewhere in the U.S.S.R., which, pending further studies and inoculation experiments, he places in the 'yellows' group of virus diseases, as there is no evidence of any bacterial or fungal organism being involved. So far the disease has nowhere assumed significant proportions, but as it was found on a large number of hosts, namely, *Cirsium oleraceum*, chicory, *Chrysanthemum aureum*, *Sonchus oleraceus*, *T. officinale*, *Matricaria inodora*, *Valeriana officinalis*, *Aegopodium podagraria*, *Carum carvi*, *Plantago major*, and *Cynoglossum officinale*, the possibility of an epidemic outbreak must not be overlooked. The disease is considered to be potentially a serious threat to kok-saghyz, as it renders the plant entirely useless. The main symptoms are deformation and discoloration of the inflorescences, leaf chlorosis, and frequently stunting and a bushy habit of growth; in short, the entire complex typical of yellows. However, it differs from aster yellows in inducing more severe and frequent deformation of the inflorescences, and in not infecting some of the most typical of its hosts, such as *Callistephus*, *Lactuca*, *Lycopersicon*, and *Petunia*.

Society of Chemical Industry: Food Group (Microbiological Panel).—*Chem. & Indust., 1944*, 26, pp. 237–239, 1 diag., 1944.

At a London meeting of the Microbiological Panel of the Food Group, Society

of Chemical Industry, on 19th April, 1944, papers were read on different aspects of soil sterilization. W. F. BEWLEY ('Some problems in soil sterilization') stated that the first year's tomato crop on new land usually amounts to 50 tons or more per acre: ten years later the yield may have fallen to 35 tons, due to (*a*) the accumulation of insect pests and pathogenic micro-organisms in the soil, and (*b*) the condition known, in default of more precise information regarding its nature, as 'soil sickness'. Soil sterilization by means of heat or chemical agents is the remedy for both these pathological states. Steam sterilization is superior to the chemical process, freeing the soil from pathogens and restoring fertility in a remarkable degree.

One problem in the cultivation of plants in steamed soil is their tendency to rapid vegetative growth at the expense of the fruiting system. This effect is believed to be correlated with the extraordinary increase in the rate and extent of root growth in steam-sterilized soil, which may be restricted in pots or other containers. Another difficulty is the expense of the engineering operations involved in steam sterilization, the cost of which ranges in peace time from £180 to £200, and to-day from £250 to £300 per acre.

W. J. C. LAWRENCE, in his paper on 'Soil sterilization and seedling growth' drew attention to the formation in soil partially sterilized by heat of nitrogenous compounds, notably ammonia, sometimes in sufficient quantities to retard seed germination and seedling growth. Experiments at the John Innes Horticultural Institution in 1934, following a large-scale failure of crops on steamed soil, showed that tomatoes and most other plants used by the earlier research workers on steam sterilization were relatively tolerant of 'excess' ammonia. It was found possible to fix the bulk of the ammonia by the addition of superphosphate to the sterilized soil. An improved technique of high-pressure steam sterilization was also devised, and is now widely used, enabling the grower to sow seeds of all kinds at once, without waiting for the soil to 'recover'.

A. H. DODD ('Considerations in chemical soil sterilization') referred to the use of a photo-electric instrument for the colorimetric determination of minute quantities of phenols in the soil. The method of administration of the higher boiling phenols in emulsion form is important. The globules of the emulsion are adsorbed to the soil particles and the degree of adsorption, which depends on the surface tension of the solution, is never sufficiently high, in the case of a 1 per cent. emulsion, to inhibit bacterial metabolism. This regulated surface adsorption is thought to be one of the factors in the control of fungal diseases, e.g., that caused by *Didymella* [*lycopersici*], by summer watering with diluted emulsions of higher boiling phenols.

Two papers by H. LEES and J. H. QUASTEL were respectively entitled 'A new technique for the study of soil sterilization' and 'Effect of chlorate administration on soil nitrification', the latter being followed by a discussion.

[An abstract of these papers also appears in *Nature, Lond.*, cliii, 3894, pp. 736–738, 1944.]

MCCLELLAN (W. D.). **A seedling blight of Castor Bean, Ricinus communis.**—*Phytopathology*, xxxiv, 2, pp. 223–229, 4 figs., 1944.

A species of *Alternaria* was consistently isolated from the cotyledonary leaves and young shoots of blighted Conner castor bean (*Ricinus communis*) seedlings in 1942 at the Plant Industry Station, Beltsville, Maryland, where the fungus was responsible for pre- and post-emergence damping-off and was likewise found to be present, in the mycelial stage, throughout the seed caruncles. The pathogenicity of the fungus was established by inoculation experiments on green, semi-ripe, and fully mature capsules, and on seedlings both in process of emergence from sterile quartz sand and at three weeks old, all of which gave positive results.

Large areas of the leaves of the early infected seedlings became water-soaked, flaccid, and covered with faintly zonate, dark brown, necrotic lesions, about $\frac{1}{4}$ in. in diameter, the lesions on those inoculated later being similar, but smaller and fewer.

Three species of *Macrosporium* previously described on the same host, viz., *M. ricini* from Japan and Korea [*R.A.M.*, ix, p. 610], *M. cavarae* from Italy [ibid., i, p. 304], and *M. compactum* Cke from Texas (*J. Linn. Soc. Lond.*, xvii, pp. 141–144, 1880), of which the two last-named are regarded as identical with the author's species, the name *A. compacta* (Cke) n. comb. being assigned to these three, while *M. ricini* continues to occupy a separate position. The spores of the writer's fungus are without elongate beaks, 14·0 to 38·5 by 7·0 to 19·5 (mean 21·4 by 10·8) μ.

Carvajal (F.) & Edgerton (C. W.). **The perfect stage of Colletotrichum falcatum.**—*Phytopathology*, xxxiv, 2, pp. 206–213, 5 figs., 1944.

The perithecial stage of a *Physalospora* has been found in profusion on dead and dying leaf blades, sheaths, and under sides of the midribs of sugar-cane, *Saccharum barberi*, *S. sinense*, *S. spontaneum*, *S. robustum*, and on the leaves of *Leptochloa filiformis* in Louisiana cane fields, generally following the production of *Colletotrichum falcatum* conidia [*R.A.M.*, xxii, p. 225]. Monoascospore cultures of the fungus produced an abundance of typical red-rot conidia, 357 of the 497 tubes yielding the dark strain and the remaining 140 the light-coloured one [ibid., xxi, p. 162]. Inoculation experiments on Co. 281 and C.P. 33/243 canes with conidia developing in monoascospore cultures resulted in the production of the characteristic red-rot symptoms, thereby fully establishing the genetic connexion between the two stages of the pathogen. The ascigerous phase of *C. falcatum* has been identified as *P. tucumanensis*, collected by Spegazzini in Argentina and described by him in *Rev. Fac. Agron., B. Aires*, ii, pp. 227–258, 1896. A technical diagnosis in English is given in the present paper.

The black perithecia of *P. tucumanensis*, 85 to 250 in height by 100 to 260 μ in width, are usually located between the fibrovascular bundles on the leaf sheaths and blades, often entirely filling the intervening space, nearly submerged with only the ostiole protruding. The clavate asci, 50 to 118 by 7·4 to 19·2 (mostly 70 to 90 by 13 to 18) μ, are thickened at the apex, and the unicellular, hyaline, straight to fusoid, elliptical to ovate ascospores measure 12·5 to 30 by 5 to 11·1 (18 to 22 by 7 to 8) μ. The very abundant paraphyses are usually unbranched and filled with granules or oil droplets. Ostiolar periphyses are abundant and conspicuous.

The perithecial stage was developed in the laboratory on sterilized cane, sorghum, and cane leaves and strips of filter paper inoculated with a culture of *C. falcatum* under humid conditions. *P. tucumanensis* was shown to be homothallic, perithecia being readily produced from single ascospore cultures. The eight ascospores from an ascus gave rise to identical cultures of equal pathogenicity.

Edgerton (C. W.) & Carvajal (F.). **Recent investigations on the red rot of Sugar Cane.**—*Sug. Bull., N.O.*, xxii, 4, pp. 26–29, 1943. [Abs. in *Sugar*, xxxix, 3, pp. 44–45, 1944.]

Although red rot of sugar-cane [*Colletotrichum falcatum*] has been recognized in Louisiana since 1908, knowledge of the life-history of the fungus, an important limiting factor in the sugar industry of the State, has been slow to accumulate. Up to 1942, the pathogen was known only in the conidial stage [see preceding abstract], but it has since been learnt that the spores may germinate on any part of the host, producing single-celled, thick-walled appressoria, which cause heavy infection when washed off the leaves on to the inner surface of the leaf sheath. Under ordinary field conditions, every leaf, leaf sheath, bud, root-band, and stalk

is covered with appressoria capable of originating an infection. Out of these observations arises the question of the hot-water treatment of seed cane, which would appear to hold some promise of success.

Hickman (C. J.). **Phycomycetes occurring in Great Britain. 1. Pythium mamillatum Meurs. 2. Pythium anandrum Drechsler. 3. Pythium aphanidermatum (Edson) Fitzpatrick.**—*Trans. Brit. mycol. Soc.*, xxvii, 1–2, pp. 49–51, 52–54, 63–67, 51 figs., 1944.

A strain of *Pythium mamillatum* isolated from diseased *Viola* roots in Britain [*R.A.M.*, xxiii, p. 343] formed, in water culture, sporangia, which, when terminal, were spherical to subspherical, and 16 to 25 (average 20·3) μ in diameter, and when intercalary were subspherical, subglobose, or somewhat piriform, and 18 to 44 by 16 to 18·9 (25·9 by 18·6) μ. They germinated readily, forming 10 to 15 reniform zoospores, which in the resting stage were spherical to subspherical and 8 to 10 μ in diameter.

The fungus grew well on maize extract agar, the colonies reaching a diameter of 90 mm. in about 50 hours at 30° C. Aerial mycelium was absent. Oospores appeared after four days. The oogonia were terminal or intercalary on lateral hyphae. The oogonial wall bore a variable number (occasionally only one) of short, straight or curved, blunt protuberances. The oogonia measured 12 to 20 (average 16·8)μ in diameter, or including the protuberances, 18 to 28 (22·9) μ. The antheridial stalk was sometimes strongly arched. The oogonia were completely or almost completely filled with smooth-walled, spherical oospores 12 to 20 (average 16·4) μ in diameter.

This strain corresponded closely with that obtained by Meurs from sugar beet seedlings [ibid., viii, p. 188]. Inoculation experiments indicated that the fungus was only slightly pathogenic to *Viola* roots.

From strawberries received from Scotland the author isolated (from pieces of root) *P. anandrum* [ibid., xviii, p. 651], apparently the first European record for this fungus. Asexual reproduction occurred sparingly. Large, irregularly oval or more elongated, non-papillate or papillate sporangia, 52 to 140 by 20 to 50 (average 91·4 by 39·2) μ, appeared in cultures on hemp seed in sterile distilled water, some extended distally in tubular fashion. Sporangial proliferation was occasionally noted. Some sporangia produced germ-tubes at one or both ends terminating in secondary sporangia. Sexual organs formed quickly and abundantly in maize extract agar and on mycelium growing from cultures on this medium in sterile Petri's solution. The terminal oogonia on short, stout, lateral branches bore numerous spines and measured 26 to 36 (33·8) μ in diameter including the spines. The oospores measured 14 to 22 (19·8) μ in diameter. The pathogenicity of this soil fungus to strawberry was not tested. There were no antheridia, the spherical oospores developing parthenogenetically.

In June, 1942, the author isolated from wilted, mature glasshouse cucumber plants a *Pythium* which he identifies provisionally as *P. aphanidermatum*. When pieces of infected stems were placed in sterile distilled water, sporangia developed which varied from slightly thickened but otherwise undifferentiated hyphal segments to irregular, sometimes branched, diversely lobulate elements. Lobulate sporangia were also produced on maize extract agar and in water culture from this medium. In these water cultures many sporangia were produced, and germinated readily, giving rise to numerous zoospores. Sexual organs appeared after five to six days in cultures on maize extract agar. The spherical oogonia were borne terminally, often on short lateral branches, and were fertilized by one, occasionally two, barrel-shaped intercalary or, occasionally, terminal antheridia. Sometimes, the antheridial hypha was distinctly seen arising from the same hypha as the oogonium. Each oogonium gave rise to a single, spherical oospore.

On maize extract agar the oogonia measured 24 to 32 (average 26·5) μ in diameter, and the oospores 20 to 28 (22·1) μ. On mycelium growing from maize extract agar cultures in sterile distilled water, the oogonia measured 20 to 30 (24·8) μ, and the oospores 16 to 24 (20·6) μ. The results of inoculations of young cucumber plants and fruits strongly suggested that the fungus was the primary cause of the disease.

THIRUMALACHAR (M. J.), SWAMY (B. G. L.), & BASHEER AHMED KHAN (K.). **Contributions to the flora of Nandi Hills. Part I. Some interesting smuts and rusts.**—*J. Mysore Univ.*, N.S., Sect. B, iii, 2, pp. 195–204, 23 figs., 1943.

Included in this list of 20 smuts and rusts of the Nandi Hills are four new species [without Latin diagnoses] and one new combination. Mention may be made of *Puccinia purpurea*, *Sphacelotheca sorghi*, and *Sorosporium filiferum* on sorghum, *Uromyces hobsoni* on jasmine [*R.A.M.*, xx, p. 409], *Hemileia vastatrix* on coffee, *Hapalophragmium ponderosum*, producing large tumours anatomically similar to those of crown gall [*Bacterium tumefaciens*] on *Acacia leucophlaea*, and *Ustilago cynodontis* on *Cynodon dactylon*.

KRASSILNIKOV (N. A.). Определитель лучистых грибков. **Actinomycetales.** [Classification of ray fungi. Actinomycetales.]—148 pp., 49 figs., Moscow-Leningrad, Acad. Sci. U.S.S.R., 1941. Roubles 9·50. [Received February, 1944.]

In an attempt to classify the Actinomycetales found, mainly in soil, in the U.S.S.R., on the basis of morphological characters, especially of the spores and sporophores, some general rules are laid down for the cultural studies of Actinomycetales. This monograph, which includes several new species [with diagnoses in Russian only] and new combinations, provides keys in Russian for the identification of species, and annotated descriptions of genera and species. The author recognizes two families: Actinomycetaceae [cf. *R.A.M.*, xxiii, p. 150], comprising 44 species and 3 subspecies of *Actinomyces*, 33 of *Proactinomyces*, 33 of *Mycobacterium*, and 10 of *Mycococcus*; and Micromonosporaceae, consisting of the single genus, *Micromonospora*, with 9 species. There is a bibliography of 263 titles.

BARGHOORN (E. S.) & LINDER (D. H.). **Marine fungi: their taxonomy and biology.** —*Farlowia*, i, 3, pp. 395–467, 7 pl., 4 graphs, 1944.

In this joint paper, D. H. Linder undertakes a classification of the fungi [*R.A.M.*, xxii, p. 327] collected on wood and cordage submerged in the sea off the United States coast. His list contains ten new genera, 21 new species, and two new combinations of Fungi Imperfecti and Pyrenomycetes. E. S. Barghoorn gives the results of a physiological study of seven of the species which were found to grow on media of varying salinity and in sea water three times the normal salinity, indicating that they are capable of an adaptation to, or tolerance of, the saline conditions in the sea. All the species studied, except *Amphisphaeria maritima*, grew best in media with an initial P_H above 7·6, and poorly or not at all in acid media. These results are again interpreted on grounds of physiological modifications in these fungi, which occur in adaptation to marine environment. Examination of their natural substrata, wood or rope partly or entirely submerged in salt or brackish tide waters, showed that the fungi penetrate and ramify in the cell walls of wood and cordage fibres, inducing decay by enzymatic hydrolysis of the cellulose and other constituents of the cell wall, in a manner comparable to that of terrestrial wood-destroying fungi. Laboratory experiments under controlled conditions demonstrated the ability of these 25 marine species to attack the various constituents of wood in culture.

WOLLENWEBER (H. W.) & HOCHAPFEL (H.). **Beiträge zur Kenntnis parasitärer und saprophytischer Pilze. V, 2. Diplodia und ihre Beziehung zur Fruchtfäule.** [Contributions to the knowledge of parasitic and saprophytic fungi. V, 2. *Diplodia* and its relation to fruit rot.]—*Arb. biol. Anst.* (*Reichsanst.*), *Berl.*, xxiii, 4, pp. 387–404, 5 figs., 1943.

The first part of the present study (*Z. Parasitenk.*, xii, pp. 165–250, 1941) dealt with eight species of *Diplodia* concerned in fruit-rotting, and in this further contribution the results of investigations on another four are fully described. They comprise *D. patellaris* (Wallr.) Mont. on elm (*Ulmus americana*) twigs from Michigan, originally described by Wallroth as *Sphaeria patellaris* from plum in Germany; *D. palmarum* (Cke) Wr n. comb. (syn. *Sphaeropsis palmarum* Cke) on unripe coco-nuts at Kifumangao, East Africa; *D. palmicola* (Fr.) Thüm. (*Sphaeria palmicola* Fr.) on grapefruit from the Banda Islands, Dutch East Indies; and *D. paradisiaca* (Mont.) Wr n. comb. (*Sphaeropsis paradisiaca* Mont.) [*R.A.M.*, xviii, p. 507] on black spots on the skin of an imported banana, unripe coco-nuts from East Africa, in the company of *D. palmarum*, a *Cassia sieberiana* stem from Sierra Leone, and a fig root from Brazil.

D. palmarum was the only one of these species that failed to attack apples (Pineapple Pippin) and quinces in inoculation experiments, though *D. patellaris* made very slow progress, requiring 28 days for the complete disorganization of the fruits at room temperature, while the corresponding period for *D. palmicola* and *D. paradisiaca* was less than a week. The two last-named species also infected lemons and oranges, *D. paradisiaca* being further pathogenic to bananas. *D. palmarum* is closely related, in respect of its spore dimensions, 19·1 by 9·6, mostly 17 to 22 by 7 to 13 μ, to various other species, e.g., *D. sarmentorum* (22 by 9·7 μ) and *D. palmicola* (12 to 28 by 7 to 15, mean 21 by 11·4 μ), but it differs from the former in its pycnidial characters and the longitudinal striation of the brown spores, and from the latter in the absence of pseudophysoids and of a reddish tinge in the mycelium, greater sensitiveness to high temperatures (no growth at 37° C.), and failure to cause rotting of pome fruits. Synonyms of *D. palmarum* are *Phoma palmarum* Sacc., *Macrophoma palmarum* Berl. & Vogl., *Botryodiplodia palmarum* (Cke) Petr. & Syd., and probably *D. sicula* Scalia.

D. palmicola, with which *D. epicocos* Cke (1877) and *D. cococarpa* Sacc. are regarded as synonymous, was one of the most active agents of rotting of apple, quince, lemon, and orange fruits, causing total decay of the last-named in wound inoculation experiments in a week and producing on the other hosts in the same time lesions 3 to 4 cm. in diameter. At the end of a fortnight all the fruits were rotten, the citrus fruit tissues being brown and those of the pomes black. Pycnidia with an abundance of brown, mostly uniseptate spores, 12 to 28 by 7 to 15 (21 by 11·4) μ, developed on the skins of all the fruits in a month. The spore dimensions of *D. palmicola* agree with those of *D. natalensis* Stevens, which is believed to represent the imperfect stage of *Physalospora rhodina* [ibid., vi, p. 127], and if this determination be correct, the species would also number among its hosts *Albizzia*, mango, and sweet potato in India and tea in Ceylon.

The average spore dimensions of the isolates of *D. paradisiaca* from the four above-mentioned hosts were 20 to 50 by 10 to 22 (28 by 14) μ, and therefore agree reasonably well with those of *B. theobromae* (27·25 by 14·2) μ and *D. natalensis* (24 by 15) μ, with which *M. vestita* and *D. cacaoicola* are regarded as synonyms. *D. radula* Berk. & Br. (Fungi of Ceylon, No. 785, 1875), the ellipsoid spores of which measure, according to Saccardo (Syll. Fung., iii, p. 371 [1884]), 25 μ in length, is probably another synonym. All four strains produced a pink to carmine aerial mycelium on malt extract, oatmeal, and Brown's starch agars and rice mash at 37°, while the colour of *D. palmicola* from citrus on the same media was similar

but rather duller. At a later stage olive-green to blackish tones developed in all four species. In contrast to these thermophile representatives of the genus, most of the other species tested, e.g., *D. palmarum*, *D. sarmentorum*, *D. pseudodiplodia*, and *D. mutila* made no growth at 37°, and at no point within their temperature range did a reddish coloration appear. The reddish tints of *D. paradisiaca* also developed more slowly, and on certain substrata only, at 18° to 23°. In inoculation experiments the strains of *D. paradisiaca* from banana, *C. sieberiana*, and coco-nut caused total spoilage of apple, quince, orange, lemon, and banana fruits in a fortnight, the banana isolate also being pathogenic to tomato, pear, and plum. The rotted quince and banana tissues were black and those of the other fruits brown. Some weeks later the mycelium and pycnidia ruptured the skins, which in the case of the citrus fruits was covered with a verrucose to tomentose coating and nodules up to the size of a pea (botryoid pycnidial nodules). The relatively few tests carried out with the fig isolate of *D. paradisiaca* on apple fruits, cut leaves and unripe banana (*Musa discolor*) fruits, and edible fig leaves showed it to be equally destructive with the other strains under investigation.

The ellipsoid-ovate or fusiform to subcylindrical, finely punctuate, mostly uniseptate spores of *D. patellaris* measure 16 to 40 by 9 to 22, mostly 23 to 32 by 10 to 14 (25 by 12) μ. They are hyaline at first but turning yellow to brown while still attached to the sporophores. Revised descriptions of each of the four species studied are given.

WILTSHIRE (S. P.). **Presidential address. The organization of the study of systematic mycology.**—*Trans. Brit. mycol. Soc.*, xxvii, 1–2, pp. 1–12, 1944.

Discussing in broad outline the nature of the problem that confronts the systematic mycologist with the existence of 37,500 'good' species and about 100,000 names, the author suggests a number of practical ways of dealing with this very difficult position. These, briefly summarized, are: the issue of a complete list of all species described, reduced to a minimum by the continual elimination of doubtful species; of lists of obligate and recently established facultative synonyms, with reference to critical opinions; of a catalogue of the classical mycological herbaria, showing their location, or a catalogue of type collections; the establishment of a clear procedure to be followed in the absence of types; a well-indexed literature capable of being kept up to date; and finally, a loose-leaf flora recording the salient features of known species. Regarding types of microfungi, it is pointed out that an author rarely specifies one particular preparation or plant part as the type and almost uniformly, therefore, any portion of a type collection has equal value wherever it may be deposited, provided it carries the fungus recognized as that originally described.

BOND (T. E. T.). **The 'phloem necrosis' virus disease of Tea in Ceylon. I. Introductory account, symptoms, and transmission by grafting.**—*Ann. appl. Biol.*, xxxi, 1, pp. 40–47, 2 pl., 1944.

This is a full account of the history, distribution, and symptomatology of phloem necrosis of tea in Ceylon [*R.A.M.*, xxii, p. 43]. The virus causing the disease is stated to be systemic, but a masking of its effects may occur to an unusual degree. From 1940 to 1942 the virus was transmitted by grafting (chiefly root-grafting) to nine clones, of Formosa, Java, and Ceylon origin. These belong in the main to the 'low-jat' type, while some of the commercially favoured 'high jats' proved to be carriers, showing no reaction to the virus itself, but capable of transmitting it to further susceptible scions. The problem of the control of the disease is discussed, but no definite measures recommended pending further investigations. The causal virus is believed to belong to the 'yellows' group, and is referred to as *Camellia* virus 1, following K. M. Smith's classification.

DIACHUN (S.), VALLEAU (W. D.), & JOHNSON (E. M.). **Invasion of water-soaked Tobacco leaves by bacteria, solutions, and Tobacco mosaic virus.**—*Phytopathology*, xxxiv, 2, pp. 250–253, 1944.

Non-motile bacteria, represented by *Staphylococcus aureus*, tobacco mosaic virus, inanimate particles (India ink), and solutions of certain toxic chemicals, viz., 1 in 1,000 mercuric chloride, 1 in 100 copper sulphate, and 3–3–50 Bordeaux mixture, were experimentally shown to be capable of entering water-soaked tobacco leaves. In tests with *Bacterium angulatum* [*Pseudomonas angulata*] on water-soaked and untreated leaves, the numbers of colonies developing on agar plates prepared from tissues of the former samples inoculated by pouring suspensions of 1 to 10, 1 to 100, and 1 to 1,000 on the leaves were 2,000 to 10,000, 2,000 to 5,000, and 150 to 800, respectively, as against none in cultures from the non-water-soaked controls [*R.A.M.*, xxi, p. 431]. The figures in comparable tests with *S. aureus* were 5,000 to 20,000, 1,000 to 3,000, and 20 to 100, the controls again yielding none. It is concluded from these results that motility is not an essential qualification for the foliar invasion of tobacco by leaf-spotting bacteria. The fact that chemicals can enter and injure water-soaked tissue further suggests the possibility that spray injury may be promoted by naturally induced water-soaking.

COSTA (A. S.). **Quantitative studies with carborundum and its use in local-lesion tests.**—*Phytopathology*, xxxiv, 3, pp. 288–300, 1 fig., 2 graphs, 1944.

The number of local lesions induced by the tobacco mosaic virus on *Nicotiana tabacum* × *N. glutinosa*, *N. glutinosa*, and Early Golden Cluster beans was greatly increased by the use of carborundum (silicon carbide) as an abrasive [*R.A.M.*, xv, p. 737 et passim], and similar observations were made in inoculation experiments with the tobacco etch virus on *Physalis peruviana* and that of cucumber mosaic on Black cowpeas. In the case of the last-named, the abrasive permits the estimation of virus concentration in samples that could not be measured otherwise. The use of 0·1 M neutral phosphate buffer as a diluent for the cucumber mosaic virus likewise increased the number of lesions in comparison with distilled water. The action of carborundum is confined to the host, samples of the virus to which it was added behaving in the same way as the controls. In tests with the tobacco mosaic virus on *N. tabacum* × *N. glutinosa*, comparable results were given by three methods of applying the abrasive, viz., dusting, sprinkling, and adding to the juice. Of the five grades of carborundum tested, from 280- to 600-mesh, 500-mesh was the most effective, while almost as large an increase in the number of lesions on *N. glutinosa* was secured with 280-mesh aloxite (aluminium oxide).

SMITH (K. M.) & MARKHAM (R.). **Two new viruses affecting Tobacco and other plants.**—*Phytopathology*, xxxiv, 3, pp. 324–329, 2 figs., 1944.

Two new viruses are described, one first observed on an *Arabis hirsuta* plant and the other on White Burley tobacco. Though probably of little economic importance, they are of considerable interest as having unaccountably appeared (the one on *A. hirsuta* in mid-winter) on plants growing inside insect-proof glass-houses at the Plant Virus Research Station, Cambridge, England. Both viruses induce ring-spot symptoms on tobacco, but that from *A. hirsuta* is easily distinguishable by the characteristic curling and shredding of the central leaves of diseased plants. Evidence is adduced to show that the *A. hirsuta* virus, designated *Arabis* mosaic, differs from either cabbage or cucumber mosaic, with which there were reasons for connecting it. *Arabis* mosaic virus is inactivated by a ten-minute exposure to a temperature of 60° C. but not to one of 50°. In crude sap expressed from infected tobacco plants, the virus is infective at a dilution of 1 in 100, but not at 1 in 1,000. Its longevity in *vitro* at room temperature ranges from 48 to

72 hours. The virus is transmissible by means of the sap, but is not highly infectious, some difficulty being encountered in inoculation experiments during hot weather, when the symptoms are masked. Besides *A. hirsuta* and tobacco, *Nicotiana glutinosa*, *Solanum nodiflorum*, cucumber, and Canadian Wonder French beans were successfully inoculated with *Arabis* mosaic; in the case of *S. nodiflorum*, however, infection did not become systemic.

Tobacco broken ring-spot virus, so-called because of the frequent incompleteness of the rings, resembles *Arabis* mosaic in its thermal activation and dilution end-point relations, but it is longer-lived (six days at room temperature), and more readily transmissible through the sap. White Burley and Kawala Turkish tobacco, *N. glutinosa*, French beans, and cucumber contracted the broken-ring-spot in inoculation tests, the symptoms as *N. glutinosa* being mild and transient. French beans and cucumber were particularly useful in the differentiation of the symptoms caused by the two viruses.

Thomas (H. R.). **'Freckle', a spotting of Tomato fruits.**—*Phytopathology*, xxxiv, 3, pp. 341–344, 1 fig., 1944.

Alternaria solani and a species referred by C. Drechsler to *A. tenuis* have been isolated from the dark, necrotic, yellow-bordered spots, $\frac{1}{8}$ in. or less in diameter, commonly observed in Indiana on ripe canning tomatoes and known locally as 'freckle', the side of the fruits directly exposed to the sun being usually more densely covered with the blemishes. Plants from segregating generations of *Lycopersicon esculentum* × *L. pimpinellifolium* appear to be particularly susceptible to the disorder, which is of little economic importance. In 1942, inoculation experiments were carried out on tomatoes at varying stages of maturity by atomization with aqueous suspensions of the two fungi concerned, which resulted in the production on the green-mature fruits by *A. tenuis* of typical 'freckle' spots, and on green ones by *A. solani* of the small, raised, jet-black lesions characteristic of late infection by this species. Probably only those infections of *A. solani* occurring on the green-mature and ripe fruit are typical of 'freckle'.

The examination of stained epidermal strips from affected tomatoes disclosed the presence of mycelium in many of the spots, which were commonly situated below superficial cracks, especially at the bases of broken hairs. The cells in the 'freckled' areas for three or four subepidermal layers were brown and occupied by brown masses staining deeply with safranin, oil globules, and crystals. Most of the discoloured cells below the epidermal layer were collapsed. Cell distortion and discoloration apparently occur in advance of the pathogens.

It is suggested that the predominance of infection on the side of the fruits exposed to the sun may be due to a heavier deposit of an air-borne inoculum rather than to the direct effect of the sun's rays, attempts to reproduce the symptoms by means of ultra-violet and infra-red rays having failed. The increased incidence of the trouble late in the season may be explained by the heavier spore load present in the air at that time, combined with the protracted exposure of the fruits.

Gottlieb (D.). **The production of healthy shoots by wilted Tomato plants.**—*Phytopathology*, xxxiv, 3, pp. 353–354, 1 fig., 1944.

A few Bonny Best tomato plants among hundreds inoculated with *Fusarium bulbigenum* var. *lycopersici* under optimum greenhouse conditions at the Minnesota Agricultural Experiment Station [*R.A.M.*, xxiii, pp. 194, 244], though wilted themselves, produced entirely normal new shoots from the meristematic regions near the stem base. These branches, from which the pathogen was rarely isolated, flowered and even set fruit. Histological examination revealed the presence of the fungus in the vessels of all parts of the main stem, but it was exceedingly

difficult to find in the new shoots; the development of healthy new growth in such close proximity to the diseased crown and roots is remarkable.

Costa (A. S.) & Forster (R.). **Lista de hospedeiras do virus de vira-cabeça.** [List of hosts of the spotted wilt virus.]—*Bragantia, S. Paulo*, ii, 3, pp. 83–91, 1942. [English summary. Abs. in *Exp. Sta. Rec.*, xc, 4, p. 487, 1944.]

Of the 45 plants tested for their reaction to the tomato spotted wilt virus in São Paulo, Brazil [*R.A.M.*, xxi, p. 354], *Nicotiana paniculata* proved to be the best adapted to the study of local lesions.

Sarasola (A. A.). **Dos septoriosis de las Alamedas argentinas.** [Two septorioses of Argentine Poplar groves.]—*Rev. argent. Agron.*, xi, 1, pp. 20–43, 3 pl., 11 figs., 1 graph, 1944.

A comprehensive account is given of the author's studies on two diseases affecting poplars in Argentina, namely, the canker caused by *Septoria musiva* [*R.A.M.*, xx, p. 386; xxi, p. 544], observed for the first time in the country in 1941 on two-year-old trees of the 'variety' Alemán No. 7 or 'De Virginia' on the Paraná Delta Experimental Farm, and the leaf spot due to *S. populi* [ibid., xxi, p. 99], recognized since 1933. The former species has also been encountered in two other localities of the province of Buenos Aires and the latter in the Paraná Delta and near the city of Buenos Aires. To the already numerous hosts of *S. musiva* within the genus *Populus* may be added *P. laurifolia* and *P. przewalskii*, besides many 'varieties' of obscure ancestry, including 'Arnaldo Mussolini'.

S. musiva occurs in two forms, namely, as a leaf spot causing premature defoliation and as a destructive branch and stem canker which had assumed an exceptionally grave character by the autumn of 1943. The foliar lesions induced by *S. musiva* on the leaves of the lower branches and those nearest the main stem (the first and most severely attacked) are necrotic, brownish-red or dark brown, of a mottled appearance, angular, and more or less delimited by the veins. On the leaves of more coriaceous texture they are circular to angular, often resembling an eye, with a greyish centre and a darker border, the whole surrounded by a yellowish, sometimes slightly raised zone. The paler spots on the under side bear the globose or slightly depressed, thin-walled pycnidia of the fungus, which measure (in 103 collections from different hosts) 49 to 206 by 37 to 205 (mean 98·8 by 113·7) μ, and give rise to cylindrical or vermiform, hyaline, straight or curved, 0- to 4-septate spores, 18·5 to 70·0 by 2·0 to 4·9 (43·4 by 3·2) μ (average of 1,200), discharged in the form of pink cirrhi under humid conditions. Spherical spermogonia, 32·9 to 94·7 by 28·8 to 86·3 (59·6 by 52·5) μ, were detected in profusion on both sides of the fallen leaves on the ground, their centres being occupied by handle-shaped, unicellular, hyaline spermatia, 4·1 to 6·1 by 1·0 to 2·0 (4·8 by 1·4) μ. Studies on the development of the perfect stage of *S. musiva*, *Mycosphaerella populorum*, which has been observed in the United States, are in progress.

S. populi forms two types of spots on the Lombardy poplar (*P. nigra* var. *italica*), so far apparently its only host in Argentina, one circular, 3 or up to 6 mm. in diameter, and the other angular, following the principal veins and usually coalescing into a more extensive necrotic zone; both are white or pale chestnut in the centre, darkening towards the edge and surrounded by a narrow, dark, slightly raised margin. There is a superficial resemblance between these lesions and the irregular white to ashen spots with darker centres produced by *Sphaceloma populi* [ibid., xvii, p. 83], which are, however, covered with prominent, black pycnidia and are also found on the veins and petioles. The pycnidia of *Septoria populi* vary in form from the characteristic *Phleospora* type with an incomplete aperture to concave and flask-shaped with a narrow ostiole and sometimes a rudimentary beak, while under humid conditions they are commonly convex, spherical,

and of a paler colour; the dimensions range from 82·4 to 206·0 by 74·1 to 206·0 (133·9 by 109·5) μ. The pycnospores are fusoid to falcate, hyaline, predominantly (91 per cent.) uniseptate, 6 and 3 per cent. being continuous and biseptate, respectively, and measure 22·6 to 49·4 by 3·0 to 4·1 (34·4 by 3·4) μ. *M. populi* has been recorded as the perfect stage of this parasite.

Cultural studies on both fungi were made on various standard media, of which rolled oats and cherry agars proved to be the most suitable. The formation of germinable chlamydospores in culture raises the question of their probable occurrence under natural conditions. The pycno- and chlamydospores of both species germinated at 21°, 24°, and 27° C. without appreciable differences between the three temperatures in respect of the resultant mycelium.

The possibilities of control, notably by the cultivation of resistant varieties, are under consideration.

MINZ (G.). **Bees gather rust spores of Melampsora populina Kleb.**—*Hassadeh*, xxii, 6, p. 173, 1942. [Hebrew.]

Leaf rust (*Melampsora* [*larici-*] *populina*) [*R.A.M.*, xxi, p. 173] on poplar (*Populus nigra*) usually occurs in Palestine from October to November, but sometimes earlier. The rust pustules protrude from the leaf and are filled with yellow spores resembling pollen: when the rust appears, the bees come in large numbers to gather the spores. This was first observed in October to November, 1940. In 1941 rust appeared in the latter half of August. The bees gathered the spores up to the beginning of September and then disappeared. At the beginning of October the bees appeared again and thus announced a second rust attack. The use made by the bees of the spores is not known, but a glass beehive near the poplars would enable observations to be made on the point.

TEHON (L. R.). **Diseases of trees. Gleanings from the latest reports of scientific research.**—*Amer. Nurserym.*, lxxvii, 7, pp. 18–19; 9, pp. 24–25; 11, p. 18, 1943.

Since its discovery at Tryon, North Carolina, in 1935, mimosa [*Albizzia julibrissin*] wilt [*Fusarium perniciosum*: *R.A.M.*, xx, p. 612] has been reported from 55 localities along the South Atlantic coast, its range now extending from Richmond, Virginia, southwards to La Grange, Georgia, and inland from Norfolk, Virginia, and Bishopsville, South Carolina, both on the coastal plain, to Biltmore, North Carolina, in the mountains. In 1935 the number of mimosa trees at Tryon with trunks 4 in. or more in diameter was about 600, while the corresponding figures for 1938 and 1940 were 174 and 45, respectively. So destructive is this widely distributed disease that G. H. Hepting and E. R. Toole, of the Federal Division of Forest Pathology, rank it as a major problem among shade tree disorders. In addition to information already presented on the results of inoculation experiments with the fungus, *A. kalkora*, a white-flowered species, is stated to be highly susceptible, while the recently introduced Far Eastern *A. theoreli* is immune. *F. perniciosum* is capable of persisting for months in various types of soil, infected particles of which can easily be transported over short distances by rain and over longer stretches of country by streams and rivers, while it is not improbable that the fungus is also conveyed from infested to healthy areas on motor-car tyres or fenders. Direct control measures, such as spraying and soil sterilization, being ineffectual or impracticable, attempts are in progress to combat the disease by the development of resistant types of mimosa. The 508 seedlings raised from the seed of trees giving some promise of resistance were heavily inoculated through two growing seasons, by the end of the second of which there were only 31 survivors. Further tests on the latter are planned to guarantee the permanence of their resistance.

The investigations of D. E. Stuntz and C. E. Seliskar on the stem canker

(*Phytophthora cactorum*) of *Cornus nuttallii* and *Arbutus menziesii* in Washington [ibid., xxii, p. 458] are summarized.

Persimmon wilt [*Cephalosporium* sp.] has been shown by B. S. Crandall's surveys of mapped strips covering 500 miles of highways in Florida and South Carolina in 1942 [ibid., xxii, p. 489] to be maintaining, and in some regions extending, its existing territory. Thus, in a strip 28 miles long in Orangeburg County, South Carolina, there were seven wilt areas in 1942 as against one diseased tree in 1938, while in Wakula County, Florida, the number of infection foci had increased during the four-year period from 6 to 13. In north-central Florida and South Carolina the total number of wilt areas in 1938 and 1942 were 47 and 11, respectively, while by 1942 the corresponding figures were 61 and 18, respectively: in west Florida, on the other hand, where the host is scarce, there was a decrease during the period of observation from 42 to 23. The prosecution of field work on persimmon wilt is so greatly hampered by war conditions that a general appeal has been issued for reports on the suspected occurrence of the disease to be sent to B. S. Crandall, Division of Forest Pathology, United States Department of Agriculture, Athens, Georgia.

Kelley (A. P.). **The present status of American Chestnut in south eastern Pennsylvania.**—11 pp., The Landenberg Laboratory, Landenberg, Pennsylvania, U.S.A., 1944. [Mimeographed.]

After briefly reviewing the early history of chestnut blight (*Endothia parasitica*) [*R.A.M.*, xxiii, p. 282] in the United States and the threat the disease constitutes to the sweet edible chestnut (*Castanea dentata*) the author records observations made on plots since 1924, some of which have already been noticed [ibid., xix, p. 443].

One plot, visited in December, 1943, demonstrated that survival of the American chestnut cannot take place through sprouts from old stumps, whereas another which had escaped serious injury, showed several saplings with very little blight. In 1939, a six-acre tract of woodland where chestnut was still plentiful was set aside for experimental purposes, and in 1943 there were 115 healthy seedlings, 27 healthy sprouts, and 7 'blight-infected'. The author concludes that the chestnut is far from extinct and that the prospect of stamping out blight is better to-day than it has been at any time in the last 40 years. If crews of men could be employed to collect and burn the comparatively small amount of spore-bearing material present in the woods, it is thought that the seedling chestnuts would grow up unaffected. A single 'clean-up' would have to be checked several times for overlooked and later infections, but the task, though difficult, is not considered insurmountable.

Zentmyer (G. A.). **Vascular chemotherapy.**—*Trees*, vi, 1, pp. 7, 16–17, 2 figs., 1 diag., 1943.

Following recent advances in science chemotherapy has been recognized as a highly promising approach to plant disease problems, in particular to the control of vascular diseases, involving as it does the introduction of chemicals directly into the sap stream where the vascular fungi develop. Investigations on these lines of the Dutch elm disease (*Ceratostomella ulmi*) [*R.A.M.*, xxiii, p. 156] and some vascular diseases of vegetable crops, have been conducted during the past two or three years at the Connecticut Agricultural Experiment Station. The research was based on one of the most plausible recent theories in medical chemotherapy, according to which sulphanilamide and similar drugs are effective against bacteria because of the structural resemblance of their molecules to those of certain vitamins required by the bacteria. On account of this resemblance the bacteria are believed to 'mistake' the chemical for the similar vitamin. As it has been recently discovered that vitamin B6 (pyridoxin) [cf. ibid., xxii, pp. 218, 323] is

essential for the normal development of *C. ulmi*, the problem was to find a chemical that the fungus could 'mistake' for this or other vitamins it requires. In the laboratory, several chemicals were found to inhibit the growth of *C. ulmi* in culture. In field treatment, however, no effective control has as yet been achieved, although significant reductions in the severity of disease were obtained by injecting various organic chemicals into small elm trees infected with *C. ulmi*, maples suffering from a *Verticillium*, and eggplants affected with *V.* wilt.

Lohwag (K.). **Der Buchenschwamm im Prater.** [The Beech fungus in the Prater.] —*Zbl. ges. Forstw.*, lxix, 2, pp. 54–58, 3 figs., 1943.

During the last 15 years the writer has observed many cases of infection by wood-destroying Polyporaceae among hardwoods in the Prater Park, Vienna. Thus, *Polyporus sulfureus* causes a red rot of willows [*Salix* spp.] and alders are occasionally attacked by *Phellinus* [*Polyporus*] *torulosus* and *Ganoderma applanatum*, but the most serious depredations are due to the beech or tinder fungus (*Ungulina fomentaria*) [*Fomes fomentarius*], the chief host of which in the Prater is the horse-chestnut. Infection is believed to date from the war period of 1914–18, and the resultant white rot is steadily spreading in a wide radius from the original foci, while old diseased trees lose large branches, covered with the pale grey fruit bodies of the fungus, in every storm. In a few cases of restricted local infection it may be possible to save valuable trees by the excision and burning of the diseased material and protective treatment of the cut surfaces, but in general these costly operations will only retard the course of the decay, so that the more radical measure of prompt felling is preferable.

P. squamosus is the most destructive tree parasite in the majority of Viennese parks, and the outbreaks of *F. fomentarius* will in all probability pave the way for its entrance into the Prater. Neither fungus is fastidious in its choice of hosts; mycelial development appears to be somewhat more rapid in *F. fomentarius.*

Hausam (W.) & Kuntara (W.). **Mikrobiologische Untersuchungen an Fichtenrinden.** [Microbiological studies on Spruce bark.]—*Collegium, Haltingen, 1943*, pp. 130–139, 1943. [Abs. in *Chem. Zbl.*, cxv (i), 6, p. 406, 1944.]

From varicoloured deposits and brownish-red stains on spruce bark bacteria, yeasts, moulds, and wood-inhabiting fungi were isolated, most of which induced similar stains on spruce bark agar and changes in the tannin, and more especially the non-tannins (sugars) in spruce bark emulsions, coupled with an increase in insoluble constituents. Pentachlorphenol, raschit [*R.A.M.*, xix, p. 318], and trichlorphenol in appropriate concentrations inhibited the growth of these organisms on spruce bark, with the exception of *Ophiostoma* [or *Ceratostomella*] *piceae*, to which the fungicidal observations do not apply, since it did not develop at all under the experimental conditions.

Ulbrich (E.). **Über einige Ophiostoma-Arten und die Blaufäule der Nadelhölzer.** [On some *Ophiostoma* species and the blue rot of conifers.]—*Notizbl. bot. Gart. Berl.*, xv, pp. 303–311, 1941. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 11–12, pp. 230–231, 1944.]

The conceptions of 'blue stain' and 'blue rot' are defined and differentiated. The former is caused by species of *Ophiostoma* or *Ceratostomella*, which do not in the first place impair the durability of the wood: if, however, the latter is insufficiently dried before manufacture, the long-lived, black mycelia of the fungi may reappear and spoil the paint of window-frames, doors, and the like. The term 'blue rot' should be applied only to the sapwood parasites, especially *Stereum* spp. and *Polystictus abietinus*, which frequently accompany or follow the staining fungi and are responsible for true decay.

ULBRICH (E.). **Wachstumsbeobachtungen an Fruchtkörpern einiger Polyporaceen und Boletaceen.** [Observations on fruit body growth in some Polyporaceae and Boletaceae.]—*Notizbl. bot. Gart. Berl.*, xv, pp. 258–278, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, xcvi, 11–12, p. 216, 1944.]

Daily measurements were made of the growth of the fruit bodies of two Polyporaceae, *Ganoderma lucidum* and *Polyporus squamosus*, and two Boletaceae, *Boletus edulis* and *B. luridus*. In all four species the cap began to expand only when the longitudinal growth of the stalk ceased, after which development proceeded at a uniform rate day and night. The fructifications of *G. lucidum* survived about 100 days, with two sporulation periods of up to a week. *P. squamosus* grew more rapidly and was shorter-lived, with only one period of spore dispersal [*R.A.M.*, xviii, p. 215] lasting a few days. The *B.* spp. lived for 12 to 14 days and sporulated for two to four shortly before the cessation of growth.

SCHEFFER (T. C.) & CHIDESTER (MAE S.). **Significance of air-dry wood in controlling rot caused by Poria incrassata.**—*Sth. Lumberm.*, clxvi, 2091, pp. 53–55, 1943.

In loblolly pine [*Pinus taeda*] sapwood blocks, 1 by 1 by ½ in., inoculated with three strains of the building-decay fungus, *Poria incrassata*, two from Virginia and one from Missouri, and placed in the drying room with a maintained relative humidity of 65° and a temperature of 80° F. the adjustment of the moisture content to 8 per cent. resulted in the death of the organism within one day. At moisture contents between 13 and 22 per cent. the period of survival became progressively longer, but in no case did it exceed 13 days. In naturally infected wood from decayed buildings the maximum survival period ranged from 25 to 32 days, owing partly to the specimens being large and painted. The strain of *P. incrassata* from this material, inoculated into wood blocks in the laboratory, succumbed in 13 days following the reduction of the moisture content from 30 to 22 per cent.

It is concluded from these data that the risk of survival of *P. incrassata* in thoroughly air-dried wood for periods exceeding a month is negligible. Even in the most humid regions of the United States the maximum moisture content of such wood does not ordinarily rise above 26 per cent., and in most sections and seasons it is under 20.

MUNTZ (H. H.). **The preservative treatment of fence posts for southern farms.**—*Sth. Lumberm.*, clxvii, 2097, pp. 65–66, 68, 3 figs., 1943.

Particulars concerning the relative durability of the various species of hardwoods used for fence posts on farms in the southern United States have already been furnished from another source [*R.A.M.*, xxiii, p. 322]. Consequent upon tests at the Delta Experimental Forest, Stoneville, Mississippi, the following hot- and cold-bath schedule is recommended for the treatment of average-sized posts (7 ft. long with a 4½ in. top diameter): ash 90 and 40 minutes, respectively, bald cypress [*Taxodium distichum*] sapwood 90 and 15, white elm [*Ulmus americana*] 90 and 15, rock elm [*U. thomasi*] 90 and 20, hackberry [*Celtis* (?) *laevigata*] 75 and 15, honey locust [*Gleditschia triacanthos*] 90 and 15, maple [*Acer*] 90 and 20, oak [? overcup = *Quercus lyrata*] 90 and 15, pecan 105 and 60, persimmon 105 and 50, sweet gum [*Liquidambar styraciflua*] 90 and 15, and willow [*Salix*] 75 and 20. Penetration generally ranges from ⅛ to ¼ in., representing an absorption of 8 lb. oil per cu. ft. or ¾ gal. per post of the above-mentioned size. Seasoning for one to two months before impregnation is advisable to facilitate infiltration of the oil and prevent cracking after immersion. The plant used at the Experimental Forest consisted of two 1,200-gal. tanks, placed end-to-end with a Dutch oven under one and a working platform and guard-rail round each, prompt transference of the posts from the heated to the cold tank being effected by means of a chain

hoist on an overhead trolley. For the average farm an apparatus made from two 110-gal. oil drums or other metal tanks of comparable capacity would probably be more appropriate, though permitting only of butt treatment. The oil in the hot tank should be pure coal tar creosote, maintained at a constant temperature of 220° F.; in the cold tank, kept at air temperature, the creosote oil should be mixed with an equal amount of diesel fuel oil, which costs only about one-third as much as creosote. The cost of the oil required for the treatment of one post usually varies between 10 and 30 cents, but a substantial reduction can be effected by bulk purchases and modifications of the method of immersion whereby the hot bath is applied to the whole length of the post but the cold one only to the lower half. In any case, the cost of preservation is nominal compared with the increased service obtained, the life of treated woods of the less durable species amounting to 15 or 20 years as against only a few for the untreated.

Davis (W. C.), Wright (E.), & Hartley (C.). **Diseases of forest-tree nursery stock.**—*For. Publ. civ. Conserv. Cps* 9, iv+79 pp., 1 pl., 14 figs., 1942. [Received July, 1944.]

In this work the authors present information regarding the causes of the more prevalent diseases found in forest-tree nurseries in the United States, their chemical treatment, and general practices that will reduce losses occasioned by such diseases. The points dealt with cover preventive measures (e.g., selection and preparation of nursery sites, drainage, sanitation, cultural practices, etc.), diseases not of fungal origin (injuries due to weather, mechanical agencies, deficiency diseases, etc.), fungal diseases of broadleaf species, diseases of specific hosts, fungal diseases of conifers and the control of all these, mycorrhiza, spraying, and the preparation of spray mixtures and care of equipment. On pp. 46–49 a key to the fungal diseases of conifers is presented. Directions are given for spraying against conifer rusts. Diseases of specific hosts dealt with (pp. 34–45) include, among others: *Marssonia fraxini* [*Mycosphaerella effigurata*: *R.A.M.*, xxi, p. 54] on ash leaves, *Coccomyces lutescens* [ibid., viii, p. 120] on *Prunus serotina*, *P. virginiana*, and *P. melanocarpa*, causing shot hole, *C. prunophorae* on *P. americana* (which is resistant to *C. lutescens*), *Chalaropsis thielavioides* [ibid., xxi, p. 19; xxii, p. 219] and *Gnomonia ulmea* [ibid., xx, p. 610] on elm, *Phytophthora parasitica* on black locust [*Robinia pseud-acacia*], *Sclerotium bataticola* [*Macrophomina phaseoli*] on maple, [*Acer*: cf. ibid., xxi, p. 275], and *P. cinnamomi* causing root rot of walnut [cf. ibid., xviii, p. 825].

Lorenz (R. C.). **Discolorations and decay resulting from increment borings in hardwoods.**—*J. For.*, xlii, 1, pp. 37–43, 2 figs., 1944.

The increment borings commonly made by foresters in trees have been observed to induce discolorations, cankers, and decay. The author's investigations on 19 bored basswood (*Tilia americana*), 13 sugar maple (*Acer saccharum*), 13 yellow birch (*Betula lutea*), and 10 paper birch (*B. papyrifera*) trees in northern Minnesota showed that stain (which is of chemical origin unconnected with micro-organisms [*R.A.M.*, xxiii, p. 200]) invariably develops in the wood adjacent to the holes, while fungal damage is prevalent but not universal. The insertion into the holes of plugs of black locust [*Robinia pseud-acacia*] heartwood failed to prevent the development of stain but somewhat reduced the incidence of heart rots (*Polyporus* and *Pholiota* spp.). Common wound fungi included species of *Torula*, *Coniochaeta*, *Fusarium*, *Ceratostomella*, *Peniophora*, and *Alternaria*. The colour of the stains was reddish-yellow in the birches, dark grey in the basswood, and salmon-coloured, with small, dark green marginal streaks, in the sugar maple. A staining of stored paper birch bolts, originally reported by I. W. Bailey (*Bot. Gaz.*, l, pp. 142–147, 1910) and observed by the writer since 1927, was likewise experimentally shown

to be quite unrelated to microbiological activity. The defect appears to exert no adverse effect on the strength of the wood.

HASKELL (R. J.). **Disinfectants and protectants prevent seed losses.**—*Food Packer* (formerly *Canning Age*), xxv, 5, pp. 42–43, 1944.

Directions are given for the treatment against seed- and soil-borne diseases of peas, tomatoes, sweet corn [maize], Lima beans [*Phaseolus lunatus*], spinach, and beets. Wrinkled, 'sweet' varieties of peas, such as Surprise, Perfection, Alderman, and Thomas Laxton, are particularly liable to decay by soil fungi, the smooth, starchy Alaska and related types being more resistant. Seed disinfection of the latter has hitherto been considered superfluous, but with the development of modern chemical protectants it appears advisable to extend the scope of the treatment to cover this group. The preparations recommended for application to peas are spergon ($1\frac{1}{2}$ oz. per bush. seed), arasan ($1\frac{1}{2}$ to 2 oz.) [*R.A.M.*, xxiii, p. 328], and semesan (2 to $2\frac{1}{2}$ oz.), their prices per lb. being $1.00 to 1.40, $1.15 to 1.60, and $2.00 to 2.50, respectively. The admixture of fine-grade graphite powder (1 oz.) for seed lubrication purposes is desirable in the case of semesan and optional in that of arasan; it is not required with spergon.

Among the tomato diseases partly controllable by seed treatment are bacterial spot [*Xanthomonas vesicatoria*], bacterial canker [*Corynebacterium michiganense*], anthracnose [*Colletotrichum phomoides*], and the blights caused by *Septoria* [*lycopersici*] and *Alternaria* [*solani*], respectively [ibid., xxiii, p. 318]. Seed may be treated by 25 minutes' immersion in hot water (122° F.) or five minutes in mercuric chloride (1 in 2,000), or with new improved ceresan (1 oz. in 9 gals.), followed in all cases by the use of a protectant against damping-off and seed decay, e.g., one hour's immersion in copper sulphate (2 oz. per gal.), the seed to be planted immediately afterwards, or dusting with semesan ($\frac{1}{2}$ oz. per 15 lb.) or arasan (1 level teaspoonful per lb.).

Sweet corn seedling blights and seed decay may be combated by treatment with arasan, semesan jr., or barbak C ($1\frac{1}{2}$, $1\frac{1}{2}$, and $1\frac{1}{2}$ to 2 oz. per bush., respectively). Spergon and arasan (both at 2 oz. per bush.) are recommended for the control of seed rot and damping-off in Lima beans, and the same preparations may be useful in producing good stands of 'snap' beans. Red and yellow copper oxides are effective against seed decay and damping-off in spinach, but since they are not generally available at present, the following may be substituted: arasan (2 oz. per bush.), zinc oxide (1 lb. per 100 lb. seed), semesan ($4\frac{1}{2}$ oz. per 100 lb.), or one hour's immersion in copper sulphate (2 oz. per gal.). Damping-off of beet may be reduced by dusting with arasan or semesan (4 and 1 oz. per 100 lb. seed, respectively), or by the copper sulphate dip, as for spinach.

HOPKINS (J. C. F.) & PARDY (MARIE H.). **Diseases of fruit, flowers, and vegetables in Southern Rhodesia. 8. Yellows disease of Cabbage.**—*Rhod. agric. J.*, xli, 2, pp. 63–67, 2 figs., 1944.

In February, 1943, cabbage plants affected with yellows (*Fusarium conglutinans*) [*R.A.M.*, xxii, pp. 234, 291] were received for examination at the Department of Agriculture, Southern Rhodesia, and subsequent investigations confirmed the presence of the disease in the Colony. The worst cases occurred during hot, dry weather, and during the recent drought in the Umtali district the crops were almost entirely destroyed.

Infected plants may show up in the seed-bed or from two to four weeks after transplanting. They are stunted and pale yellow-green with small, malformed leaves and the stems may become twisted and warped. The stem in cross-section shows a dark ring (but never a black ring, characteristic of black rot, *Xanthomonas campestris*) and the overlying tissues die off and are shed. Many plants wilt and

finally die. The causal fungus was isolated in pure culture and its pathogenicity was established in inoculation experiments, the fungus being re-isolated. The conidia were preponderantly 0-septate; a few 3-septate ones were seen, but 1-, 4-, 5-, or 7-septate conidia were rare. The microconidia were ovoid, straight, or reniform, and the macroconidia elongate and tapering at both ends. Spore measurements ranged from 6 to 10 by 2 to 3 μ on lupin stems (0-septate) to 29 by 4 to 5 μ on potato dextrose agar (7-septate) and 23 to 33 by 2 to 4 μ on oat agar (4-septate). It is considered that identification of the fungus with *F. conglutinans* is warranted.

WALKER (J. C.), STAHMANN (M. A.), & PRYOR (D. E.). **Efficacy of fungicidal transplanting liquids for control of clubroot of Cabbage.**—*Phytopathology*, xxxiv, 2, pp. 185–195, 2 figs., 1944.

A tabulated survey is given of four seasons' laboratory and field experiments in Wisconsin in the control of club root of cabbage (*Plasmodiophora brassicae*) by means of the introduction into the transplanting liquid of various chemicals, of which mercuric chloride (1 in 750 or 1 in 1,500 at the rate of 60 to 125 ml. per plant) gave the most encouraging results, both on mineral and muck soils. Although the elimination of infection was not complete, the increased yields secured by the treatment often repaid the cost of the latter many times. In one test, for instance, the yields per acre in the untreated, 1 in 1,500, and 1 in 750 plots (138 ml. per plant) were 7·82, 12·51, and 13·07 tons. The mercuric chloride treatment should not at present be regarded as a substitute for such well-established remedial practices as crop rotation, seed-bed sanitation, and liming, but merely as a useful accessory, especially on mildly infested muck soils where the high buffer action frequently counteracts the beneficial effect of liming.

MACLACHLAN (J. D.). **Control of water-core of Turnips by spraying with borax.**—*Sci. Agric.*, xxiv, 7, pp. 327–331, 1944.

Losses (except as stock feed) from water core, a physiological disease of turnips due to boron deficiency, has been estimated in Ontario at as high as 20 per cent. in some years. Attempts to control the disorder by soil application of boron met with many failures, probably partly owing to the high lime content of the soil. Even an application of 100 lb. per acre at the Ontario Agricultural College resulted in no control. Almost complete control, on the other hand, was obtained in small plot experiments during 1940–1 and field trials in 1942 with boron spraying [*R.A.M.*, xxii, p. 163]; similar experiments on a commercial scale in 1943 gave equally outstanding results. It was found that no foliar burning was caused by spraying and no mechanical injury to leaves occurred from the wheels of sprayers whether drawn by horse or tractor, that it was sufficient to spray the upper surfaces of leaves only, and that any type of spraying machine could be used so long as a uniform coverage was obtained. On the basis of the tests, and pending further investigations with regard to the use of stickers and spreaders, the following spray composition and spraying programme are proposed. Borax dissolved in water at the rate of 8 lb. per 40 gals. (or a saturated solution of borax in cold water) is mixed with bentonite clay at the rate of 2 lb. to 40 gals. borax solution, the mixture is screened into the spray tank, and $\frac{1}{2}$ pint liquid orvus is stirred into it. Forty gals. of spray is sufficient for one acre. Only one spraying, applied when the roots are 1 to $1\frac{1}{2}$ but not more than 2 in. in diameter, is stated to be sufficient in cases of mild or moderate attack of water core, but a second one, applied one month later, is necessary to control severe outbreaks.

KASSANIS (B.). **A virus attacking Lettuce and Dandelion.**—*Nature, Lond.*, cliv, 3896, p. 16, 1944.

The name dandelion (*Taraxacum officinale*) yellow mosaic virus is suggested for

the agent of a disease of lettuce recorded during three years in various parts of Britain, and found to be also responsible for the chlorotic rings and spots commonly observed in dandelion, a perennial host, which accordingly is selected for the common name of the virus. The disease is stated to be more severe than the common lettuce mosaic [*R.A.M.*, xix, p. 561] and to be readily distinguished from it. Bronzing of young lettuce leaves appears one to two weeks after infection. In the greenhouse this initial fine, brown necrosis developing along the veins and in the interveinal areas is usually followed by chlorosis, dwarfing, and malformation of the whole plants; out-of-doors, necrosis remains the chief symptom, the leaves turning black and shrivelling up, and whole plants being rendered worthless. The virus was only transmitted by sap inoculation when some abrasive, such as carborundum, was used; it was also transmitted by *Myzus ornatus* and *M. pseudosolani*, but not by *M. persicae*. The vectors became infective only after at least three hours' feeding on infected material, and the number that becomes infective increases with increased feeding time. But even after feeding for as long as three days the aphids ceased to be infective within an hour.

VAN KOOT (Y.). **Enkele onderzoekingen betreffende de Fusarium-ziekte bij de Komkommer.** [Some investigations relating to the *Fusarium* disease of the Cucumber.]—*Tijdschr. PlZiekt.*, xlix, pp. 52–72, 1943. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 11–12, p. 232, 1944.]

The following *Fusarium* species were isolated from cucumbers affected by foot rot and wilt in Holland: *F. solani* and its var. *martii*, *F. orthoceras* and its var. *longius*, and *F. angustum*. The symptoms induced by artificial infection were identical with those observed in nature, consisting in a brown discoloration of the stem base and portions of the roots, severe attacks invariably resulting in the death of the plants. Melons and kidney beans also proved susceptible in inoculation experiments, *F. solani* var. *martii* being the chief pathogen of the latter host. Of the soil-sterilizers tested in soil cultures of the fungi in Erlenmeyer flasks, chloropicrin and formalin were the most effective.

IVANOFF (S. S.). **Resistance of Cantaloupes to downy mildew and the Melon aphid.**—*J. Hered.*, xxv, 2, pp. 35–39, 3 figs., 1944.

Under the conditions prevailing in southern Texas four cantaloupe varieties of West Indian origin, Smith's Perfect, Green Fleshed Rocky Dew, Orange Fleshed Rocky Dew, and Cuban Castilian have proved resistant to downy mildew (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*) [*R.A.M.*, xxii, p. 54] and *Aphis gossypii*. Crosses were made between these and various non-resistant commercial varieties in an attempt to develop a shipping cantaloupe of the Hale's Best type that should be similarly resistant. Resistance to downy mildew and aphids appeared as partly dominant in the F_1 generation, but in later ones highly resistant lines were obtained which also possessed desirable commercial qualities. Further improvements of these strains are being attempted and it is hoped to produce a melon resistant to the powdery mildew [*Erysiphe cichoracearum*] as well as to *P. cubensis* and *A. gossypii*.

BEATTIE (J. H.), DOOLITTLE (S. P.), BEATTIE (W. R.), MAGRUDER (R.), & WEBSTER (R. E.). **Production of Peppers.**—*Leafl. U.S. Dep. Agric.* 140, 7 pp., 1944.

Damping-off of chilli pepper (*Capsicum frutescens*) [*R.A.M.*, xviii, p. 440] causes seed decay and seedling collapse; most of the seed decay can be prevented by dusting the seed with cuprocide (one level teaspoonful per lb. seed) or semesan. Excessive watering of the seed-beds should be avoided, and plants in cold frames should be well ventilated. Bacterial spot [*Xanthomonas vesicatoria*: ibid., xix,

p. 451] can be controlled by soaking the seed for not more than two minutes in a 1 in 2,000 solution of mercuric chloride, followed by thorough washing in water and immediate drying. Applications of Bordeaux mixture (3–3–50) at 7- to 10-day intervals will help to check leaf infection. Peppers should not be grown near tomatoes, or be planted on the same land more often than once in three or four years. Tomatoes should never be followed by peppers in successive years. The same seed treatment and spraying methods may be used against *Cercospora* leaf spot [*C. capsici*: ibid., xix, p. 507], though spraying may not be economically worth while unless the disease is severe. Rotation may also reduce losses.

The only control methods of any avail against *Sclerotium* blight [*S. rolfsii*: ibid., xxi, p. 126] are rotation and clean culture.

It was reported that *Fusarium* wilt [? *F. annuum*: ibid., xiv, p. 7] can be partially controlled by setting the plants on ridges or by avoiding excessive irrigation. Against *Phytophthora* blight [? *P. capsici*: ibid., xxii, p. 380] spraying with Bordeaux mixture has been recommended; seed should never be saved from fruits of affected plants.

Blossom-end rot, induced by low soil moisture [ibid., xiv, p. 344], is aggravated by heavy applications of nitrogenous fertilizer; where irrigation is practised, care should be taken to maintain an even supply of moisture in the soil.

Against anthracnose [*Glomerella cingulata*: loc. cit.] crop rotation and the use of seed from sound fruits are the best means of control. Of the mosaic diseases attacking peppers [ibid., xxi, p. 408] the commonest is caused by cucumber mosaic virus. Control consists in clean cultivation in and about the fields to destroy perennial weeds, and the application of nicotine sulphate as a spray or a dust. Peppers should not be planted near cucumbers, celery, or tomatoes.

Porter (R. P.) & Parris (G. K.). **Sweet Potato sprout treatments for the control of Fusarium wilt, ineffective on the eastern shore of Virginia.**—*Trans. Peninsula hort. Soc., 1943*, pp. 85–88, 1944.

Data [which are tabulated] obtained during 1943 in Virginia showed that a pre-planting dip of sweet potato sprouts in either wettable spergon, semesan bel, yellow cuprocide, fermate, or thiasan had no significant effect in reducing the incidence of stem rot or blue stem, caused by *Fusarium oxysporum* var. *batatas* or in increasing the yields [*R.A.M.*, xxii, p. 510].

Iljin (W. S.). **Der Stoffwechsel bei der Weinrebe während der Kalkchlorose.** [Vine metabolism during lime-induced chlorosis.]—*Gartenbauwiss.*, xvii, pp. 338–381, 1943. [Abs. in *Chem. Zbl.*, cxiv (ii), 18, p. 1642, 1943.]

In the writer's studies on vine chlorosis [*R.A.M.*, xxii, p. 144] at the Institute of Balneology, Baden, near Vienna, and at the Karl University, Prague, the analysis of chlorotic foliage of vines growing in high-calcium soils revealed an abnormally high water content, which approximated more and more closely to the normal as recovery proceeded. In the early part of the summer the sugar content of the diseased leaves is very low, but it slowly rises until equality with the normal ones is reached in August; at this time the sugar in the latter undergoes rapid disorganization, whereas it is retained in the chlorotic foliage until the end of the summer. Starch formation is not impeded in the chlorotic vines, nor does the late summer disorganization typical of normal plants take place. Diseased leaves contain more citric acid than normal ones. Nitrogen is present in chlorotic foliage up to 30 per cent. in soluble form (mostly amino acids), in contrast to the healthy leaves, in which the soluble nitrogen decreases with advancing maturity. The iron content of chlorotic leaves was often higher than that of healthy ones, and in no case appreciably lower, but the former were poorer in calcium than the latter, the ratio

of calcium to potash rising in normal and falling in diseased vines in the course of development.

Lyon (A. V.). **Characteristics of black spot.**—*Aust. Dried Fruits News*, xx, 4, p. 9, 1943.

A popular note is given on the life-history of vine black spot or 'bird's eye fungus' [*Elsinoe ampelina*], which develops in Victoria [*R.A.M.*, xxiii, p. 88] following showery weather in November: in most seasons, however, the rainfall is insufficient at the critical period to promote heavy damage by the pathogen. Spraying with Bordeaux mixture is purely preventive and quite ineffectual once the pathogen has gained ingress and formed lesions on the foliage. At one time it was customary to treat the dormant vines with an acid iron swab or spray to kill the fungus on the wood, but this useful practice having often proved superfluous under the weather conditions of recent seasons, it has been widely discontinued.

Kaiser (M.). **Folgerungen der Forschung über Kälte- und Trockenresistenz kleinster pflanzlicher Zellen für die Methodik der Viruskonservierung.** [Consequences of the study of cold and drought resistance of the smallest plant cells for the technique of virus preservation.]—*Biol. gen.*, xvi, pp. 513–553, 1942. [Abs. in *Chem. Zbl.*, cxv (i), 6, p. 358, 1944.]

A comprehensive survey is given of the literature on the effects of cold and drought on plant cells. Death from these causes is attributed to a colloid-chemical, irreversible change in the condition of the cell substance associated with dehydration through ice formation or desiccation. Such substances as carbohydrates and glycerine appear to be capable of penetrating into the interior of the cells, where their well-known protective action against cold and the dehydration of the tissues is evidently exerted. Viruses are able to withstand minimum temperatures and extreme dryness for very lengthy periods, whence practical applications for their preservation may be deduced.

Seiffert (G.). **Viruses diseases in man, animal, and plant.**—ix+332 pp., 7 figs., New York, Philosophical Library, 1944. $5.00.

This is a translation (by Marion L. Taylor) of a book first published in 1938 and already noted in this *Review* [*R.A.M.*, xvii, p. 616]. No attempt appears to have been made to bring the book up-to-date. It opens with a section (pp. 1–90) on general aspects of viruses and concludes (pp. 298–322) with notes on methods of virus investigation. The main body of the book (pp. 91–263) discusses the most important virus diseases of man, animals, and plants; those of plants, apart from incidental references in other parts of the work, being briefly dealt with in a 10-page chapter.

Laboratorio de Cryptogamia. *Ex* **Memoria Estación de Fitopatología Agrícola de La Coruña, 1942.** [Cryptogamic Laboratory. *Ex* Report of the Corunna Station of Agricultural Phytopathology, 1942.]—*Publ. Estac. Fitopat. agríc. Coruña* 23, pp. 21–57, 35 figs., 2 diags., 2 graphs, 1943.

In further studies on chestnut ink disease (*Phytophthora cambivora*), Leonian and Geer's standardized method for the comparison of sporangial dimensions in different *P.* spp. [*R.A.M.*, ix, p. 135] was found by P. Urquijo Landaluze to be inapplicable to the fungus in question owing to the paucity of fruit bodies developing under the prescribed conditions. The most suitable medium for the purpose in view was a 0·25 per cent. soil extract, on which the mean sporangial dimensions (in μ) of eight isolates of *P. cambivora* (100 sporangia of each) were as

follows: Petri's 43·6 by 27·6, Leonian's 42·4 by 23·0, Dufrénoy's 43·6 by 24·1, two of the writer's (from Corunna and Meirás) 54·1 by 31·3 and 54·4 by 31·4, respectively, from *Castanea dentata* 55·9 by 29·0, walnut 63·8 by 35·8, and *Erica* 56·3 by 32·2. In cross-inoculation experiments the numbers of positive infections secured on chestnut seedlings with Petri's, Leonian's, Dufrénoy's and the author's isolates, and those from *C. dentata, Erica,* and walnut were 11 out of 19, 16 out of 18, 7 out of 10, 84 out of 85, 10 out of 10, 10 out of 10, and 9 out of 10, respectively. A few tests were made on the Japanese chestnut, *C. crenata* var. *tamba,* on which positive results were obtained with Leonian's, Dufrénoy's and the author's isolates and the *Erica* strain. In the case of walnut, out of four inoculations each with Petri's, Leonian's, and Dufrénoy's isolates, and the *C. dentata, Erica,* and walnut strains, and eight with the author's collections, 3, 2, 0, 5, 2, 4, and 3, respectively, were successful. These data are regarded as suggestive of the existence within *P. cambivora* of multiple varieties or forms which are not, however, specifically related to any particular host. In this connexion attention is drawn to the marked morphological and biological simularity between the *Erica* strain and the Meirás chestnut isolate, indicating the potential importance of the heath tribe in the propagation of the pathogen. The mechanism of resistance in *C. crenata* var. *tamba* to the agent of ink disease appears to be of the same order as in the walnut, i.e., infection takes place but an *a posteriori* defensive reaction is set up which localizes its development.

It is of interest to note that, out of five inoculations on chestnut with *P. citrophthora,* a species closely allied to *P. cambivora,* four were positive.

The examination of sections, stained with diphenyl carbacide, of chestnut seedling roots treated against the ink disease with the lethal dose (1 in 100,000) of copper carbonate or copper oxychloride showed that the fungicides do not remain fixed in the tissues, but diffuse into the protoplasmic contents. In other experiments with cultures of the fungus on malt extract, certain zones were traced with a rod dipped in one or other of the copper compounds, at some distance from which the further advance of the mycelium was arrested, whereas normal growth proceeded on the other parts of the dish, denoting that the infinitesimal amount of the copper ion diffusing into the medium sufficed to inhibit the development of the pathogen.

Four *C. crenata* var. *tamba* plants growing in Shive and Robbins's nutrient solution in Erlenmeyer flasks, were inoculated by J. R. Sardiña with (1) Heald's (United States) strain of *Endothia parasitica* [ibid., xxii, p. 53], (2) a non-pigmented strain of *Cytospora* sp., (3) a strain of the same secreting a raspberry-coloured pigment, the two last both isolated in Spain from areas of chestnut bark subjacent to cankers and bearing orange pustules, and (4) a species of (?) *Ceuthospora* from a cankered Japanese variety of *Castanea crenata.* The plant inoculated with *E. parasitica* died, but attempts at the reisolation of the fungus from the necrotic portion of the stem were unsuccessful. The non-pigmented *Cytospora* induced temporary wilting.

Inoculation experiments conducted by J. R. Sardiña with the chilli 'blanching' virus [ibid., xxi, p. 404] on *Nicotiana glutinosa* resulted in the separation of the two component parts of the complex, viz., tobacco mosaic and tobacco leaf curl. Transmission was effected by mechanical means alone without the intervention of aphids. Tobacco plants inoculated early in 1942 with the mosaic component developed pallor of the interveinal areas, a symptom apparent in adult leaves only, while the leaf-curl virus merely induced crinkling of the lamina near its juncture with the petiole. In *N. glutinosa* a few minute, yellow dots constituted the sole evidence of mosaic infection, while the leaf-curl component caused the appearance of yellow necrotic zones. As the season advanced, however, the symptoms arising from each fresh series of inoculations became increasingly fainter and finally disappeared, presumably owing to the heat of the greenhouse. The investigations

have therefore been discontinued pending the provision of proper equipment for the study of plant viruses.

A virus of the mosaic type was transmitted by rubbing from stock (*Matthiola* [*incana* var.] *annua*) [ibid., xviii, p. 459] to *Malcomia littorea* with 90 to 100 per cent. positive infections, which assumed, however, a quite atypical and very severe form, consisting of necrotic areas along the leaf veins, isolated at first but later extending over the entire lamina and involving all the new foliage in succession.

Cauliflower mosaic [ibid., xxii, p. 122] was successfully transferred to all the cabbage plants used in inoculation tests.

New records for the year include a species of *Acrocylindrium* in the collar and roots, and one of *Clonostachys* in the tap root, of chestnuts unsuccessfully inoculated with *Cytospora* sp.; *Lophodermium pinastri* on pine [ibid., xxii, p. 186]; *Oidiopsis sicula* [*O. taurica*] on chilli [ibid., xix, p. 167; cf. xxi, p. 404]; *Peronospora viciae* on peas; and *Corticium solani* on the root-collar, petioles, and under sides of potato leaves, no trace of the *Rhizoctonia* stage being discernible on the underground system.

Experiments were carried out in a number of vineyards in different parts of the country under the supervision of J. R. Sardiña and P. Urquijo Landaluze to determine the relative efficiency of various formulae designed to save copper in the treatment of vine downy mildew (*Plasmopara viticola*), the results of which may be summarized as follows. The only substitutes for the standard 2 per cent. Bordeaux mixture that can be recommended are Menozzi's formula, consisting of 1 kg. each copper and iron sulphate per 100 l. water, with the addition of sufficient lime to induce an alkaline reaction, and a mixture of 1 kg. copper sulphate and 1·5 l. concentrated lime-sulphur per 100 l. water, again with sufficient lime for alkalinity. Taking the number 10 to represent absolute protection, the two formulae in question are assigned grades of 8·4 and 9, respectively, the performance of Bordeaux mixture also being expressed by the latter figure. Actually, the best control was obtained by dusting with copper carbonate or copper oxychloride (9·7 and 9·2, respectively), both of which, however, are more wasteful of copper than Bordeaux or the other formulae tested, and therefore cannot be considered for fungicidal purposes during the present juncture. The outcome of the laboratory experiments by P. Urquijo Landaluze to determine the relative mortality among sporangia of *P. viticola* on slides or vine leaves exposed to contact with various fungicides (either by spraying for 15 minutes or two hours' immersion) supported the conclusions reached in the field concerning the efficacy of the copper sulphate (1·5–1 or 1–1) and Menozzi formulae, which were rated at 84, 76, and 78 per cent., respectively, compared with 90, 95, and 98 per cent., respectively, for 1, 2, and 3 per cent. Bordeaux mixture.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lv, 4, pp. 153–158, 9 figs., 1944.

Leaf spot due to *Cercospora beticola* [*R.A.M.*, xxi, p. 358; xxii, p. 508] is the commonest disease of silver beet and beetroot in New South Wales. New beet crops should not be planted near old, infected ones. The seed should be dusted with one of the proprietary organic mercury dusts (1 level teaspoonful per lb.) or copper oxychloride dust (4 level teaspoonfuls per lb.). If silver beets become affected, the diseased leaves should be removed and burnt, and the plants kept well trimmed back. As a rule, spraying is not worth while, because if the crop is kept growing quickly and is constantly picked, the fungus will be unable to establish itself. Should spring-sown seedlings be attacked at an early stage, Bordeaux mixture (1–1–10) may be applied after the infected leaves have been removed, a second application being made seven to ten days later. Only young plants which have not reached the picking stage should be sprayed.

In some parts of the metropolitan area lettuce-growing is unprofitable in seasons when tomato spotted wilt virus [ibid., xxi, p. 244] is prevalent.

Seedling cabbages and cauliflowers should be sprayed at weekly intervals from the time the seedlings are 1 in. high with Bordeaux mixture (1–1–10) against downy mildew [*Peronospora parasitica*].

The chief diseases of strawberries in New South Wales are crinkle [ibid., xxii, p. 32], leaf spot [*Mycosphaerella fragariae*: ibid., xxi, p. 533], leaf scorch [*Diplocarpon earliana*; ibid., xxi, p. 463], leaf blight [*Dendrophoma obscurans*: loc. cit.], and *Rhizoctonia* wilt [ibid., xiv, p. 348]. Crinkle is the most serious, but the leaf-spot diseases may sometimes cause loss, and wilt may be a limiting factor in the heavier soils under wet conditions. Runners should not be used for propagations from beds infected with wilt, and infected land should not be planted to strawberries. Steeping the sets in Bordeaux mixture or copper oxychloride is a useful safeguard.

Coleman (Madeline F.) & Reid (J. J.). **The serological relationship of Phytomonas tumefaciens and Alcaligenes radiobacter.**—Abs. in *J. Bact.*, xlvii, 5, pp. 420–421, 1944.

At the Pennsylvania State College a serological study was made of six strains of *Alcaligenes radiobacter* [*R.A.M.*, xxiii, p. 168] and two of *Phytomonas* [*Bacterium*] *tumefaciens*. M-phase cultures were used in the rapid immunization of animals, and cross reactions between the two species were not observed in significant dilutions, although the *A. radiobacter* strains were found to be antigenically similar and those of *Bact. tumefaciens* identical.

Conversion of single-cell strains of the two species to the Dawson S-phase was effected by serial transfer in a medium containing 10 per cent. homologous M-phase antiserum. Rapid immunization of animals with the resultant cultures yielded antiserum that did not react in significant dilution with cells of the homologous strain in the M-phase. Complete reciprocal agglutinin absorption, however, showed the single-cell strain of *A. radiobacter* in the Dawson S-phase to be serologically identical with that of *Bact. tumefaciens* in the same phase. The latter was then cultured in yeast-extract mineral salts broth containing 10 per cent. homologous S-phase antiserum, 10 per cent. homologous M-phase antiserum, and a small amount of sterile capsular material from an M-phase culture of *A. radiobacter*. Serial transfer in this medium yielded an organism serologically identical with *A. radiobacter* in the M-phase. Conversion of *A. radiobacter* in the Dawson S-phase to an M-phase serologically identical with *Bact. tumefaciens* has not been completed.

Garrigues (R.). **Recherches cytologiques sur les tumeurs à Phytomonas tumefaciens.** [Cytological researches on the tumours due to *Phytomonas tumefaciens.*]—*C.R. Acad. Sci., Paris,* ccxvii, 9, pp. 235–237, 1943.

Cytological studies on the tumours of sunflower and *Pelargonium zonale* inoculated with crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) revealed none of the abnormalities of mitosis associated with human and animal cancer and lend no support to the theory of a connexion between the plant disease and that of man [cf. *R.A.M.*, xxiii, p. 8]. As already shown by Riker [ibid., vii, p. 144 *et passim*], crown gall does not spread, like human cancer, by means of metastases, nor is there any deterioration in the general health of the majority of infected plants. The writer's *P. zonale* plants continued to flourish after several series of inoculations producing neoplasms.

Smith (C. O.) & Cochran (L. C.). **Crown gall and irrigation water.**—*Plant Dis. Reptr*, xxviii, 4–5, pp. 160–162, 1944. [Mimeographed.]

Data presented here on two outbreaks of crown gall, *Agrobacterium* [*Bacterium*]

tumefaciens [*R.A.M.*, xx, p. 3], in experimental peach nurseries in California in 1941 and 1943, where the heavy infection (up to 75 per cent. of seedlings in 1943) could not be explained by soil contamination, show that in both cases the irrigation water applied at the time of planting had passed either beneath or through bearing peach orchards. When the water came directly from mountain reservoirs and wells, the planting was largely free from crown gall. It is concluded that the two outbreaks are due to contamination through irrigation water, which may thus be regarded as an important agent in spreading crown gall. This view was further confirmed by the results of an infection experiment, in which peach seed in pots watered with tap water produced an average 7·5 per cent. infected seedlings, while those from seed watered once with wash water from peach crown galls and thereafter with tap water yielded an average of 54·4 per cent. infected plants.

VIEIRA (J. T.). **'Lagartão' ou 'vassoura de bruxa'.** ['Lagartão' or 'witches' broom'.]—*Bol. Minist. Agric., Rio de J.*, xxxi, 11, pp. 39–44, 1942 (issued 1943).

The writer briefly summarizes the available information concerning the history, distribution, symptomatology, etiology, economic importance, and control of 'lagartão' [caterpillar] or 'witches' broom' of cacao (*Marasmius perniciosus*), with special reference to the Amazon Valley, Brazil [*R.A.M.*, xxii, p. 242]. Care should be taken, in a study of the history of the disease, not to confuse the date of its first recorded appearance (1936, for instance, in Pará) with the actual presence of the fungus in the country or region under observation. Witches' broom, under its vernacular name of 'lagartão', is thought to have existed in the Amazon Valley for a century or so.

Besides cacao, *Theobroma grandiflorum* is susceptible to witches' broom. A key is given for the differentiation of the symptoms caused by *M. perniciosus* from those of die-back and pod rot (*Botryodiplodia theobromae*) canker, and wither tip, due to the combined action of sun and wind. The estimated loss of yield from *M. perniciosus* in the municipality of Santarem is of the order of 60 per cent.

POSNETTE (A. F.). **Virus diseases of Cacao in Trinidad.**—*Trop. Agriculture, Trin.*, xxi, 6, pp. 105–106, 3 figs., 1 map, 1944.

A disease of cacao observed at River Estate, Trinidad, in 1943, in several fields from 5 to 25 years old, and later found in the neighbouring Santa Cruz and Maracas valleys, was demonstrated by transmission experiments to be due to two viruses, here designated the red mottle and the vein-clearing. The red mottle virus induces the presence of a red pigment along some of the main veins of the young leaf, forming a feather-like pattern. In the mature leaf this pigment persists long after the whole leaf, which is normally pink or red when young, has turned green, and sometimes remains permanently faintly visible. Occasionally the mottle forms a network over the whole lamina. In some clones the red mottle appears on young pods, persisting until the pod is about one-third grown. Mosaic often develops on red mottle-infected trees, causing a conspicuous patchy clearing along the sides of veins, which turns yellow in mature leaves. Crinkling of the leaf and necrosis of the tip are occasional but not reliable symptoms of red mottle. The virus was transmissible by grafting to 11 seedlings out of 22, all the controls remaining healthy. The incubation period varied from 94 to 119 days (average of 98). The virus was not inactivated in budwood immersed in water for 10 minutes at 50° C. or for 45 at 43·4°.

The vein-clearing virus produces a very prominent continuous clearing of all veins, so that a yellow network forms all over the leaf. Leaf-crinkling is more pronounced with this virus than with red mottle. The virus was transmitted by grafting to four stocks, the incubation period varying from 45 to 130 days.

The disease in Trinidad resembles the swollen-shoot disease in the Gold Coast [*R.A.M.*, xxiii, p. 6] in some leaf symptoms and in the manner of spreading, but differs from it in the absence of swellings.

There were marked differences in tolerance to the two viruses, some trees suffering noticeable defoliation followed by die-back, and others remaining apparently unharmed. That this variation is genetical was indicated by the fact that in plantings of I.C.S. clones at River Estate, differences in symptoms were greater between the clones than between trees in the same clone. Both viruses appeared to spread from tree to tree in a row; there were also individuals or pairs of infected trees indicating scattered new outbreaks. In the six-year-old field of I.C.S. clones at River Estate, over 7·8 per cent. of trees were found to be infected, suggesting an alarmingly rapid rate of spread. At present the viruses seem to be confined to the western end of the Northern Range, with the Maracas valley, in which the vein-clearing virus alone had been found, as the most easterly point; they are present, either separately or together, in every field in Santa Cruz valley, with red mottle more prevalent; and in Diego Martin red mottle predominates, though symptoms of the vein-clearing virus have been observed on a few trees.

ANDRÉN (F.). **Några resultat från 1943 års betningsförsök met stråsäd.** [Some results of the 1943 cereal seed-grain disinfection experiments.]—*Växtskydds-notiser, Växtskyddsanst., Stockh.*, viii, 2, pp. 19–23, 1944.

A tabulated survey is given of the experiments conducted in Sweden in 1943 with commercial preparations for the control of cereal seed-grain diseases [cf. *R.A.M.*, xxii, p. 471]. Bunt of winter wheat [*Tilletia caries* and *T. foetida*] was most effectively combated by panogen (200 ml. per 100 kg.), followed next in order by 30 minutes' immersion in 0·125 per cent. uspulun. The data relating to rye do not permit of any very definite conclusions owing to the low incidence of fusariosis [*Calonectria graminicola*]; soaking in 0·125 per cent. uspulun gave the best results, with an average yield of 210 kg. per ha. All the fungicides tested (comprising, besides those already mentioned, U.T. 1875 b, germisan, betoxin, abavit-neu, and fusariol dusts, all at 200 gm. per 100 kg., and germisan and fusariol-neu, 0·125 per cent., 30 and 15 minutes' immersion, respectively) gave excellent control of barley stripe [*Helminthosporium gramineum*], with yield increases up to 862 kg. per ha. The best control of loose smut of oats [*Ustilago avenae*] was given by betoxin and fusariol dusts (300 gm.) and 15 minutes' immersion in 0·1 per cent. mercuric chloride-formalin, the same three preparations, especially the last-named, having been the most efficacious over the five-year period from 1939 to 1943 inclusive. In this connexion it is pointed out that *U. avenae* affords a very reliable indication of the comparative efficiency in general of seed-grain disinfectants.

On the whole, the experimental figures for 1943 are very satisfactory, the ratings assigned for the effects of treatment against wheat bunt, barley stripe, and oats loose smut being 99·5, 99·8, and 95·6 per cent., respectively, while the corresponding yield increases were computed at 12·7, 18·8, and 5·1 per cent. respectively.

CHESTER (K. S.). **Methods of appraising intensity and destructiveness of cereal rusts with particular reference to Russian work on Wheat leaf rust.**—*Plant Dis. Reptr, Suppl.* 146, pp. 99–121, 2 figs., 1 graph, 1944. [Mimeographed.]

This valuable survey consists of a digest and discussion of papers published by Russian workers during the past quarter of a century describing methods of improving the accuracy of estimations of the intensity and destructiveness of plant diseases. It is confined to an analysis of the techniques used in appraising the cereal rusts, and in particular, wheat leaf rust (*Puccinia triticina*). Contributions from workers outside Russia are mentioned only when they assist the reader to understand the Russian researches more readily.

Greenhouse method of testing dust seed treatments to control certain cereal smuts.—*Phytopathology*, xxxiv, 4, pp. 401–404, 1944.

Full directions are given for the testing, by recognized procedures approved by the Committee on Standardization of Fungicidal Tests, American Phytopathological Society [cf. *R.A.M.*, xxiii, p. 489], of dust seed-grain treatments for the control of wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetida*], loose smut of oats (*Ustilago avenae*), and covered smut and black or shallow-borne loose smut of barley (*U. hordei* and *U. nigra*). The methods are designed primarily for the evaluation of commercial materials already on the market, and of promising new preparations given adequate preliminary trials by the originators, and not, in the first instance, for the development of new fungicides.

WOODWARD (R. W.) & TINGEY (D. C.). **Cache, a beardless and smut-resistant winter Wheat.**—*Bull. Utah agric. Exp. Sta.* 312, 10 pp., [? 1944].

Cache (formerly designated 54a–40 or C.I. 11599), the new beardless variety of winter wheat described in this bulletin, has been developed in Utah from a cross made in 1927 between Ridit and Utah Kanred, and was distributed to farmers for trial in 1937. The new variety equals Relief and Utah Kanred in yield, but is superior to either of them in resistance to the local smuts (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetida*] and to lodging and shattering.

DENNIS (R. W. G.). **Occurrence of Ophiobolus graminis var. avenae on Wheat crops in the field.**—*Ann. appl. Biol.*, xxxi, 2, pp. 100–101, 1944.

During August, 1943, examinations were made of 104 oat crops, mainly in south-western Scotland, 90 of which showed varying amounts of take-all (*Ophiobolus graminis* var. *avenae*) [*R.A.M.*, xxiii, p. 130]. The disease has now been recorded in Banffshire, Aberdeenshire, Kincardineshire, Perthshire, Fife, Peeblesshire, Dumfriesshire, Kirkcudbrightshire, Wigtownshire, and Ayrshire. As many wheat crops as possible were also examined in the area visited, special attention being paid to wheat following oats. Take-all samples were secured from 15 wheat crops, seven of which had followed oats, and these samples were tested for *O. graminis* var. *avenae* by Garrett's method [ibid., xviii, p. 172], an oat grain being inserted in the lumen of the infected straw, planting effected in a sand culture, and the seedling examined for take-all lesions. The oats used were naturally infected with *Helminthosporium avenae* and *Fusarium* spp., to about 10 and 25 per cent., respectively. As it was considered undesirable to treat the seed with an organo-mercury disinfectant before insertion in the straw, the results were complicated by the presence of *F.* foot rot. There was no difficulty, however, in distinguishing between take-all and *F.* foot rot, and with regard to the point that oat seedlings affected by the latter may be more susceptible than normal plants to attack by *O. graminis*, it is stated that the proportion of seedlings showing take-all lesions was far higher than could be explained in this way. It is, therefore, concluded that at least some of the take-all in all the wheat crops represented by the samples cited was due to *O. graminis* var. *avenae*. This is supported by the ascospore measurements for six samples, each of which indicated a mean length of 100 spores considerably above that of *O. graminis*.

Confirmatory results were obtained by Garrett with two additional samples of wheat straw from Dryfesdale and Morton parishes, Dumfriesshire. The former, from a wheat crop following oats and containing numerous take-all infected volunteer oats, gave positive reactions on oat seedlings; the latter, from a first crop after old grass, bore perithecia with ascospores 85 to 121 (mean $106 \times 1{\cdot}3$) μ in length typical of *O. graminis* var. *avenae*.

Koblet (R.). **Ergebnisse und Ziele der getreidebaulichen Versuchsarbeit.** [Results and aims of experimental work in connexion with cereal cultivation.]—*Schweiz. landw. Mtsh.*, xxii, 3, pp. 57–81, 2 figs., 2 graphs, 1944.

Recent investigations on some problems of cereal cultivation, with special reference to Swiss conditions, are summarized and discussed, including Défago's work on foot rots, *Ophiobolus graminis* [*O. herpotrichus* is evidently meant] and *Cercosporella herpotrichoides* [*R.A.M.*, xx, p. 396], against which crop rotation still remains the only practicable method of control.

Blind ears in Wheat.—*Rhod. agric. J.*, xli, 3, p. 114, 1944.

In Southern Rhodesia blind ears are not uncommonly met with in wheat crops. They are found in crops making normal growth and revealing no deficiency symptoms. Such crops generally grow in patches on black sandy vlei [low-lying] soils typical of the non-irrigated granite vlei soils of the wheat belts. Soil analyses have revealed nothing to account for the condition, and no specific disease appears to be responsible. An application of 15 lb. borax per acre to land which had previously given wheat with completely blind ears resulted in a stand of approximately 100 per cent. good wheat.

Leukel (R. W.). **Spergon, arasan, and merc-o-dust ineffective for the control of Oat smut.**—*Plant Dis. Reptr*, xxvii, 25, pp. 704–706, 1943. [Mimeographed.]

When oat seed of the Colorado No. 37 variety experimentally inoculated with covered smut [*Ustilago kolleri*] was dusted with new improved ceresan, Du Bay 1452–C, spergon, arasan, and merc-o-dust (spergon and arasan being used at 1 oz. per bush. and the remainder at half this rate), and then sown, the resulting plants averaged 4, 5·5, 39·5, 40·6, and 50·6 per cent. infection, respectively, as against 48·2 per cent. for the untreated, inoculated controls.

Pichler (F.). **Zur Frage der Schneeschimmelbekämpfung.** [On the question of snow mould control.]—*Mitt. Landw., Berl.*, lviii, 36, pp. 726–727, 1943.

The damage to rye (Germany's most important cereal crop) from the snow mould [*Calonectria graminicola*] in the winter of 1941–2 is described as 'enormous'. Seed-grain disinfection alone does not give adequate control, but must be combined with rational cultural measures, i.e., use of large, heavy seeds with high germinability and vigour, of resistant varieties; rather late, sparse and shallow sowing on well-layered, firm, dry soil; omission of readily soluble nitrogenous manures from the autumn fertilizing scheme; and crop rotation. Highly satisfactory results have been obtained experimentally in the environs of Vienna by the application as a top-dressing, just before the onset of winter, of preparation 'P' (I.G. Farbenindustrie) at the rate of 50 kg. per ha., the high cost of which, however, precludes its large-scale use. The common practice of ploughing up infected stands immediately the snow melts is to be deprecated, since the surviving healthy plants, given proper care and a top-dressing, may produce quite a substantial yield in the summer.

Mukerji (B.) & Dey (N. K.). **A method for the assay of individual ergot sclerotium.**—*Curr. Sci.*, xiii, 5, p. 128, 1944.

Using Fairbairn's method for the analysis of individual ergot (*Claviceps purpurea*) sclerotia (*Pharm. J.*, 13th March, 1943), which is similar to that of Békésy [*R.A.M.*, xix, p. 94], the writers determined the alkaloid contents of the single sclerotia in a batch of material from Coimbatore, Madras [cf. ibid., xxii, p. 301], and found an average of 0·165 mg., compared with 0·145 mg. estimated by the procedure laid down in the B[ritish] P[harmacopoeia]. Individual sclerotia of the ergot on *Chrysopogon zeylanicus* in the South Indian hills gave a faint trace of alkaloids in response to Fairbairn's test, whereas *Oplismenus compositus* (also found by Padwick and

Azmatullah to be infected by *Claviceps viridis* in the Simla district) [ibid., xxiii, p. 65] gave negative results. Possibly the low alkaloidal content of grass ergots may be attributed to their parasitization by the latter species instead of *C. purpurea*, which develops medicinally valuable alkaloids in rye ovaries.

McLaughlin (J. H.). **Southern Cooperative Corn Disease Research Committee.**—*Plant Dis. Reptr*, xxviii, 3, pp. 64–76, 11 graphs, 1944. [Mimeographed.]

The results of maize disease work carried out during 1943 by the Southern Cooperative Corn Disease Research Committee, which comprises 14 workers in nine States, showed that seed treatment with semesan jr., at the rate of 3 oz. per bush. seed-grain, gave significant improvement in average seedling stands in 37·5 per cent. and highly significant improvement in 31·3 per cent. of the 16 plantings made; there were no significant differences in yield. Mesocotyls from seedlings grown from treated seed were infected with *Fusarium moniliforme* [*Gibberella fujikuroi*] and other organisms to a lesser degree than those from seedlings from untreated seed. Isolations from diseased seedling tissue yielded also *F.* sp., *Penicillium* sp., *Aspergillus* sp., *Rhizopus* sp., *Corticium* sp., *Mucor* sp., *Cephalosporium acremonium*, various bacteria, including a yellow one, *Macrophomina phaseoli* [*R.A.M.*, xxiii, p. 187], *Trichoderma* sp., *Chaetomium* sp., *Helminthosporium* sp., and *Diplodia zeae* [ibid., xxiii, p. 12]. Each of the five chemicals used in the second series of tests (semesan jr., spergon, arasan, barbak-D, and Dubay 1451-D), produced increased seedling stands in 75·5 per cent. of the total number of plots, but neither had any significant effect on yields. The *G. fujikuroi* infestation was again heavier in seedlings grown from untreated seed than in those treated with any of these dusts. A comparison of the three rates of application, $1\frac{1}{2}$, $\frac{3}{4}$, and $\frac{3}{8}$ oz. per bush. seed, of the above-mentioned five chemicals and merko, dow # 5, and amac-118·5-C, in their effect on seedling stands, revealed no significant differences between the performance of the three doses.

Standen (J. H.). **Variability of Nigrospora on Maize.**—*Iowa St. Coll. J. Sci.*, xvii, 2, pp. 263–275, 1 fig., 1943.

Two species of *Nigrospora*, *N. oryzae* and *N. sphaerica*, differing mainly in spore size, have been differentiated on maize. This study is directed to showing whether two species can be maintained for *Nigrospora* as it occurs on maize in Iowa, from its sporulation, spore size, cultural characters, and pathogenicity.

Over a four-year period the average spore diameter of nearly 400 field collections was established; they were found to vary between the 12·6 to 13·0 μ spore class and the 17·6 to 18·0 μ one. In 1939 the distribution of average spore measurements was unimodal, and consistently on the small side; in 1941 and 1942 a slight tendency towards bi-modal distribution developed.

In numerous isolates sporulation was found to vary between abundant in two days, and none at all in fourteen days. The colour of the mycelium varied from white, through various shades of grey, to black. Its appearance could be classified as low, sparse; low, compact; cottony; fluffy; or tufted.

Mass spore isolates from large-spored collections tended to reduced spore size and very varied cultural characters; those from small-spored collections tended to produce rather larger spores in culture, and were more uniform in cultural characters.

Single-spore isolates from large-spored collections which might have been passed as *N. sphaerica* were found to show a strong tendency to become small-spored in culture and in fact typical of *N. oryzae*. When these now small-spored isolates were inoculated on to unsterilized maize cobs, they remained small-spored. The author concludes that all the *Nigrospora* material on maize can properly be referred to one species, and for this he accepts the name *N. oryzae* [*R.A.M.*, xxiii, p. 339].

McDonough (E. S.). **Studies on the cytoplasm and its inclusions in Sclerospora graminicola.**—*Amer. J. Bot.*, xxx, 10, pp. 809–813, 11 figs., 1943.

Details are given of cytological studies on the mycelium, sex organs, oospores, and germinating oospores of *Sclerospora graminicola*, particularly in regard to the cytoplasm of their structures. In addition, many microchemical tests were made on ripe oospores in an attempt to identify the large central body. Because of its staining and solubility reactions the basic substance of this body is considered to be a carbohydrate or a carbohydrate-protein complex.

Lohman (M. L.) & Stokes (I. E.). **Stem anthracnose and red rot of Sorgo in Mississippi.**—*Plant Dis. Reptr*, xxviii, 3, pp. 76–80, 1944. [Mimeographed.]

A *Colletotrichum* stem rot is reported to have caused serious losses in experimental plantings of sorgho [*Sorghum saccharatum*] at the U.S. Sugar Plant Field Station, near Meridian, Mississippi, in 1940, when only a general appraisal of damage could be made, and again in 1943, when it was particularly severe in nurseries and among mid-season and late-maturing varieties and hybrids. In the latter year the highest incidence occurred in the region to the east of the northern-central belt of prolonged spring and summer drought, with advanced stages of rot and an average of 10 per cent. stem breakage in two fields in Noxubee County and one field in Lowndes County. In 1941 only the incipient stages of rot were observed, and in 1942, although infection was general, damage was very slight, affecting only late-maturing sorghos. Systematic plot surveys in 1942 and 1943 showed that the disease differs in some respects decidedly from the *C.* stem rot of broomcorn [*S. bicolor* var. *technicus*] in Illinois [*R.A.M.*, xxii, p. 475]. The causal fungus, not yet positively identified pending comparison with *C.* isolates from other grass hosts, is stated to be, culturally and morphologically, very similar to *C. falcatum*. The chief stem symptoms of the disease in sorgho are, in general, the same as those described for red rot in sugar-cane [ibid., xviii, p. 344]: internal discoloration, from yellowish or orange to red, reddish-brown, or reddish-purple, bars of mottling, cortical anthracnose, and rot, which progresses largely upwards, appearing at first watery and dull and later shrunken, dull, and dry. Anthracnose lesions may appear first on the peduncle or any stem internode, developing from mycelium in pockets and bars. The lowermost internodes near and below the soil surface are typically free from disease, and crowns and roots are normal. In 1943 rot and anthracnose symptoms were obtained following artificial infection of stems. A study of weather conditions during the red-rot years indicated that moist periods, particularly when warm, favour infection and development of rot, probably owing to a rapid increase in potential inoculum in the presence of very succulent plant tissue; when moist periods are followed by drought, conditions are not only adverse to the plants but favourable to the rapid advance of rot, which in the more susceptible varieties proceeds from all stages of infection to the point of stem breakage within a few weeks.

Bitancourt (A. A.). **Distribuição teorica de lesões em folhas ou frutas, causadas por insetos e outros animais ou por agentes infecciosos transmitidos por vetores.** [Theoretical distribution of lesions on leaves or fruits caused by insects and other animals or by infectious agents transmitted by vectors.]—*Arq. Inst. biol., S. Paulo*, xiv, 17, pp. 243–252, 1943. [English summary.]

When lesions on citrus leaves and fruits are produced by a small number of infectious agents dispersed at random over the surface, a Poisson distribution of the number of such organs with 0 to k lesions is observed. A single insect, however, among those scattered over the foliage or fruits, may produce or transmit more than one lesion, in which case the distribution can be expressed by the formula: $p_n\,(a+b+c+d+\ldots)^n$, where p_n is the probability of the presence of n vectors on

a given leaf or fruit, and *a*, *b*, *c*, *d* . . . . . the probabilities of a given insect producing 1, 2, 3, 4 . . . . . lesions per leaf or fruit. An example is given of the application of this distribution to the number of sweet orange leaves with 0 to more than five lesions of leprosis [*R.A.M.*, xxi, p. 74] among 5,000 leaves collected at random in an orchard in the State of S. Paulo.

A statistical study of the distribution of discrete virus lesions on the foliage or fruits may give a clue to the systemic or local character of the disease, Poisson's law being normally followed in the former case, while in the latter the above-mentioned formula is more likely to be applicable.

Bitancourt (A. A.) & Fawcett (H. S.). **Statistical studies of distribution of psorosis-affected trees in Citrus orchards.**—*Phytopathology*, xxxiv, 4, pp. 358–375, 1 fig., 3 diags., 1944.

This is an expanded, tabulated account of the authors' statistical studies on the distribution of sweet orange trees affected by psorosis in 14 Californian orchards, a note on which has already appeared [*R.A.M.*, xxii, p. 63]. It is concluded from the assembled data that the spontaneous formation of root grafts between diseased and healthy trees is most likely to result in (1) the high percentage of transmission that would produce variations in incidence (from 3·8 to 70·6 per cent.) of the magnitude observed, and (2) the comparatively rapid decrease in such differences with increasing distance from a central tree. While the possibility of some other means of conveyance of the virus, e.g., by insect vectors, cannot be entirely disregarded, observational evidence to date suggests that any such method of diffusion is both slow and infrequent compared with natural root-grafting.

Fawcett (H. S.). **Prevention of psorosis.**—*Calif. Citrogr.*, xxix, 7, p. 187, 1944.

Citrus psorosis [*R.A.M.*, xxiii, p. 62 and preceding abstract] can be prevented by taking buds from healthy trees and budding them on to healthy seedlings. Seeds transmit the disease only occasionally. Many budded citrus trees may have the virus without showing any bark symptoms; orange, grapefruit, and tangerine trees finally show them, but lemons do not. A system has been instituted by the State Department of Agriculture, Sacramento, by which trees intended to serve as sources of citrus buds may be inspected and registered by number, the propagator being supplied with a letter of registration to show to prospective buyers of the progeny trees. Nearly 50 per cent. of the trees selected by nurserymen and propagators for registration have been rejected, but about 1,000 trees have so far been registered.

Klotz (L. J.) & Fawcett (H. S.). **Treatment of brown rot gummosis.**—*Calif. Citrogr.*, xxix, 7, pp. 194–195, 1 fig., 1944.

During the past seven years, many old citrus trees in California that had escaped the disease for upwards of half a century became so badly attacked by brown rot gummosis [chiefly *Phytophthora parasitica* and *P. citrophthora*: *R.A.M.*, xxii, p. 132] and had so much bark killed before the disease was found that surgery could no longer save them. Growers should make a careful inspection of the trunks and crowns of their trees during spring and early summer, when gumming makes identification easy. When treatment is required the bark should be removed by the standard method [which is described], and the treated area dusted with dry Bordeaux mixture, zinc-copper-lime (also spray-dried), or tetrachloroquinone, or painted with 1 per cent. permanganate of potash solution or a water suspension of any one of the dusts mentioned. Copper-containing materials stimulate the exudation of a clear light-coloured gum, which should be ignored. The treated lesion is left to dry, and is then covered with tree seal or white lead paint.

BROOKS (C.). **Stem-end rot of Oranges and factors affecting its control.**—*J. agric. Res.*, lxviii, 10, pp. 363–381, 1 fig., 2 graphs, 1944.

Stem-end rot (chiefly *Diplodia natalensis* and *Phomopsis* [*Diaporthe*] *citri* [*R.A.M.*, xxii, p. 430]) was found to be the most important cause of spoilage in Florida oranges purchased on the Washington market. A study was made from 1939 to 1942, first at Beltsville, Maryland, and later at Orlando, Florida, with naturally and artificially infected fruits. The best method of obtaining a continuous supply of spores of *D. citri* was to grow the fungus on sterilized snap beans in test tubes, while good spore production of *Diplodia natalensis* was secured on wheat grains, soaked over-night and then sterilized. The stem-end rot fungi were found to penetrate the fruit readily either through the cut on the stem or other parts of the button. *D. natalensis* produced decay in less than half the time required by *Diaporthe citri*, even at temperatures somewhat more favourable to the latter. Oranges that had been held in an ethylene room for 42 to 45 hours at 80° to 85° F. and 87 to 92 per cent. humidity had, two weeks after harvest, about nine times as much stem-end rot, almost entirely due to *Diplodia natalensis*, as similar oranges held for the same number of hours in an ordinary basement at approximately 70° and 80 to 90 per cent. humidity; after three weeks they had more than three times as much. Three possible reasons are suggested for the increased decay after ethylene treatment: the higher temperatures of the ethylene room, a possible stimulation of the germination of *D. natalensis* spores, and, most important of all, the ageing and weakening of the buttons.

Of various disinfectants tested, borax and sodium ortho-phenylphenate gave the best results, while formaldehyde, calcium and sodium hypochlorites, and sodium bisulphite showed no promise. Borax applied after ethylene was less than half as effective as when applied before, while the phenate was equally effective whether applied before or after. The phenate applied after ethylene was as effective as borax applied before ethylene during the first two weeks in storage at 70°, but became less effective after longer periods. The phenate was used as a 1·2 per cent. solution at 100° and caused no injury when application was followed by thorough washing, though increases in temperature led to injury. Generally, increased temperatures with a particular strength of phenate solution resulted in a greater increase in injury than in decay control. Nearly as good control was obtained with the 1·2 per cent. solution at 90° as at 100°. Including 1·2 per cent. of phenate in the water phase of a water-wax emulsion at 100° caused no injury and, in the few tests made, gave better control of stem-end rot than any other method of applying this fungicide.

CHAPMAN (H. D.), BROWN (S. M.), & RAYNER (D. S.). **Diagnosing the fertility needs of Citrus trees.**—*Calif. Citrogr.*, xxix, 7, p. 182, 1 fig., 1944.

The principal leaf, growth, and fruit symptoms of nutrient deficiencies in citrus trees are fairly well known. The early stages of deficiency are sufficiently distinctive in the case of zinc, iron, manganese, and magnesium for these deficiencies to be positively diagnosed and corrective measures instituted before serious effects have ensued. Unfortunately, the early symptoms of nitrogen, sulphur, phosphorus, potassium, calcium, boron, and copper deficiency do not become visible in any kind of tangible leaf pattern, or in growth or fruit characteristics. The authors, therefore, examined the possibilities of detecting the early stage of such deficiencies by chemical analysis of the plant. Citrus trees are being grown out-of-doors in solution cultures with known and maintained concentrations of the various mineral nutrients, and periodical analyses are made of the various parts of the trees so treated. As leaves vary in composition according to their age, tests have to be made on leaves of known age. With oranges and grapefruit, the authors use spring-cycle leaves on fruit-bearing branches. A sample of 30 to 50 leaves picked

in a circle from waist- to shoulder-height around a citrus tree gives a representative sample. In sampling an orchard, the authors examine in this manner about ten trees in a representative area of the grove.

The evidence obtained indicates that if citrus leaves contain under 0·2 per cent. potassium on a dry basis, then potassium is probably deficient in the soil [*R.A.M.*, xxii, p. 248]. Leaves containing 1 per cent. or more potassium are amply supplied. The significance of intermediate values has not yet been determined. Most orchards showed potassium values in the leaves ranging from 0·4 to 1 per cent. The same method will be used with other elements.

WATERSTON (J. M.). **Citrus culture in Bermuda.**—*Bull. Dep. Agric. Bermuda* 22, 22 pp., 1 pl., 1 fig., 1944.

In Bermuda, sour orange, lemon, and grapefruit are occasionally attacked by scab (*Elsinoe fawcetti*) [*R.A.M.*, xxiii, p. 14], incidence varying greatly from year to year, according to climatic conditions. Melanose (*Diaporthe citri*) [ibid., xxii, pp. 11, 354] causes stem-end rot of the fruit, but on a smaller scale than in Florida. The West Indian or Key lime is affected by wither tip of the leaves (*Gloeosporium limetticola*) [ibid., xiii, p. 762], though the Persian or Tahiti lime and the limequats [West Indian lime × round kumquat (*Fortunella japonica*)] are immune. The West Indian lime is also attacked by anthracnose (*Colletotrichum gloeosporioides*), but the disease is greatly reduced when the trees are starved of nitrogen. Psorosis becomes apparent on established trees just about to come into bearing. Directions are given for control.

BLISS (D. E.). **Omphalia root rot of the Date Palm.**—*Hilgardia*, xvi, 2, pp. 15–124, 6 pl., 31 figs., 5 diags., 9 graphs, 1 map, 1944.

A full account is given of 15 years' researches into the decline disease of date palms in the Coachella Valley, California, caused by *Omphalia pigmentata* and *O. tralucida* [*R.A.M.*, xxiii, p. 15]. Only about 1 per cent. of the total acreage given up to date is at present affected, but the disease is important economically by the threat it offers of further spread [cf. ibid., xvii, p. 29].

The typical primary symptom is a necrotic lesion usually confined to the underground portion and developing offshoots. The abortion of young roots is the worst type of injury. Secondary symptoms include premature wilt and death of the older leaves, retardation of terminal growth, reduction in size and number of fruit stalks, and the production of small, worthless fruits. Death usually occurs only in young seedling palms [cf. ibid., xiii, p. 694]. *Phoenix dactylifera* is the only naturally infected suscept, but the susceptibility of *P. canariensis* and *Washingtonia filifera* was demonstrated by artificial inoculations.

The pathogen enters the palm by direct mycelial penetration through the cuticle and the outer epidermal wall. A mat of hyphae becomes closely attached to the surface. The starch grains are dissolved from the underlying cells, which become discoloured and die. The mycelium invades the necrotic tissue and fills every cavity. The attack on the leaf bases is preliminary to the root-rot phase; the roots have to penetrate the older leaf bases covering the trunk. Latency may range from a few days to over five years.

Rapid infection occurred in soil at 24° to 38° C. The optimum soil temperature for the disease was 31° or slightly above, whereas that for terminal growth of date roots was about 24°. Potted seedling dates lived for three years in soil continuously covered with water. Continuous immersion of date roots, starting 48 hours after inoculation, prevented infection. Moderate to severe attack occurred in soil with P_H 5·11 to 9·65. The disease occurs in soils of widely different salt concentrations. It may spread in all directions from a focus of infection at a rate of 30 to 60 ft. a year. Secondary symptoms have been observed only in the Deglet Noor variety,

though *O.* spp. have been isolated from the roots of several others, which, however, show slight necrosis and no stunting of the plants.

The occurrence of the disease may be prevented by planting healthy offshoots in uninfected soil. The Khadrawy, Halawy, Iteema, Tazizaoot, Khustawy, Zahidi, and Tafazwin varieties and many seedlings appear to possess considerable tolerance. The relative resistance of seedling palms increases with age.

In soil treatments with potted date seedlings, 17 chemicals were tested, representing the hydroxides, nitrates, sulphates, and phosphates of hydrogen, potassium, ammonium, and calcium. Treatments with ammonium compounds resulted in the lowest percentage of aborted roots and those with the calcium compounds in the highest. The nitrates as a group gave the most effective control and the phosphates the least. In one garden, many affected palms improved after heavy applications of water and fertilizer, but severely infected palms showed no sign of recovery as a result of improved cultural methods. In preliminary experiments, carbon disulphide, chloropicrin, and ethylene oxide gave encouraging results. All killed the pathogen, and all stimulated growth of cauliflower seedlings planted 30 to 46 days after treatment to test the effect of the chemicals on the soil. Under field conditions, carbon disulphide was the most satisfactory material tested.

ROGERS (C. H.). **Cotton seed-treatment studies at the Blackland Experiment Station.**—*Bull. Tex. agric. Exp. Sta.* 634, 22 pp., 6 figs., 1943.

The two most important seedling diseases of cotton under Texas conditions are stated to be angular leaf spot (*Bacterium* [*Xanthomonas*] *malvacearum*) and sore shin (usually associated with *Rhizoctonia* [*Corticium*] *solani*, although other organisms may be present). Control of these diseases was achieved in varying degrees in the course of trials conducted at the Blackland Experiment Station, Temple, Texas, from 1938 to 1942 (some data are also given for 1932) by treating cotton seed with fungicides, or delinting, or a combination of both [*R.A.M.*, xxii, p. 478]. Seed treatment was found to increase the emergence of seedlings in about 75 per cent. of the trials, to reduce seedling infection with angular leaf spot in almost every instance, and to increase the yield of seed cotton in about 75 per cent. A decrease in yield occurred in 15 per cent., while in about 10 per cent. of the trials the treatment was without effect. Fungicides were more effective on fuzzy seed than on delinted seed. No one fungicide was consistently superior to another, and the amounts used could be varied within fairly wide limits without reducing the effectiveness of the treatment. The most satisfactory materials were 2 per cent. ceresan and 5 per cent. new improved ceresan, cuprocide, cyanamide 154–6–B, and spergon. Fungicidal dusts containing insoluble copper compounds appeared to offer promise in the treatment of cotton seed for planting in alkaline blackland soil. All methods of delinting gave good control, but in some cases the results were further improved by an additional fungicidal dust treatment. South-eastern-grown seed was found to develop much less angular leaf spot in the seedling stage (not more than 5·2 per cent.) than Texas-grown seed (up to 92 per cent.); seed treatment was, therefore, most beneficial when locally grown seed was used. The results were not improved by supplementing the fungicidal dust treatment with indole butyric acid. Separation of the seed according to specific gravity showed no consistent differences in stand or yield between the different fractions. Seed treatment was most effective where low rates of seeding were used (two seeds per hill as against five or ten); conversely less seed would be required when treated seed is used. As the cost of treatment is only 5 to 10 cents per bush. of seed, it is considered that any increase in yield would justify the slight expense.

FAWCETT (H. S.). **Fungus and bacterial diseases of insects as factors in biological control.**—*Bot. Rev.*, x, 6, pp. 327–348, 1944.

Experimental work on entomogenous parasites in relation to the biological

control of plant pests is still in a very rudimentary stage, partly perhaps on account of the intermediate position occupied by the subject between the fields of the entomologist and the plant pathologist. In the present paper the author summarizes some outstanding contributions to the knowledge of this means of combating insects, mostly those infesting citrus [*R.A.M.*, xxiii, p. 17], the results of which lead to the conclusion that further co-operative research in the largely unexplored field would well repay the necessary efforts. In this connexion it is necessary not only to determine the role of entomogenous parasites in natural control, but also to study methods of enhancing their efficiency by artificial spread under conditions where spontaneous infection does not suffice to check the activities of the pests. A bibliography of 90 titles is appended.

JENSEN (H. L.). **Microbiological investigations on the dew-retting of Flax.**—*Proc. Linn. Soc. N.S.W.*, lxvi, 5–6, pp. 276–286, 1 pl., 2 graphs, 1941. [Received August, 1944.]

The information in this paper has already been noticed from another source [*R.A.M.*, xxi, p. 370].

BICKERTON (J. M.). **Alternaria blight of Carnations caused by Alternaria dianthi Stev. and Hall.**—*Bull. Cornell agric. exp. Sta.* 790, 29 pp. 5 figs., 1943.

In investigations carried out by the author on carnation blight (*Alternaria dianthi*) [*R.A.M.*, xxii, p. 388] inoculation studies extended the suscept range of the fungus to include *Dianthus plumarius*, *D. chinensis* var. *heddewigii*, and × *D. allwoodii*. All varieties of *D. caryophyllus* were found to be about equally susceptible, though under natural conditions some are more consistently affected than others.

Infected cuttings are the chief source of inoculum for primary and secondary infections in the cutting bench. Similarly, the various chains of secondary lesions in the greenhouse and field are initiated by conidia developing on already existing lesions. The conidia are spread chiefly by water. Stomata and wounds represent the infection courts for leaf infections. Stem cankers on young plants and plant parts are initiated at the nodes by the continued expansion of a leaf lesion into the stem, the coalescence of stem lesions on uninjured tissue, or the growth of the fungus into wounds on the stem. Cankers on woody stems would appear to arise by one or other of these means before the stem becomes woody, or through cracks or mechanical injuries in the woody tissue. The conidia germinate at temperatures ranging from 37° to 88° F.; the optimum range is 64° to 81°, with a peak at about 75°. In this optimum range most of the spores germinated in eight hours. In inoculation tests, the optimum temperature for infection was about 70°. It would appear that, for infection to take place between 60° and 80°, moisture must be in contact with the conidia for at least eight to ten hours. At lower temperatures, longer wetting is necessary. The amount of infection increased in proportion to the period of wetting of the leaf surfaces, apparently owing to the proportionate increase in the number of spores that developed.

At temperatures from 67° to 81° the incubation period for stomatal leaf infections was about 28 hours, being proportionately longer at higher or lower temperatures. In the optimum temperature range, foliage symptoms associated with stem cankers appeared 10 to 60 days after inoculation.

Plants kept in the greenhouse during the summer remain almost unaffected even if they are not sprayed, and in a wet season may produce more than twice as many flowers as plants grown in the field. The severity of the disease on field-grown plants is reduced by benching early. Overhead watering in the greenhouse greatly assists in the spread of infection.

In the field, spraying with Bordeaux mixture (4–4–50) plus penetrol (1 in 600)

or raw linseed oil (1 in 400) reduces infection and increases flower production. Applications should be made either before rains or at 10-day intervals, beginning shortly after transplanting to the field and continuing until just before benching.

CAMPI (MARIA D.). **'Heterosporium echinulatum' (Berk.) Cke, nuevo parásito del Clavel Dianthus caryophyllus en la República Argentina.** [*Heterosporium echinulatum* (Berk.) Cke, a new parasite of the Carnation, *Dianthus caryophyllus*, in the Argentine Republic.]—*Lilloa Rev. Bot. Tucumán*, viii, 1, pp. 269–271, 1 pl., 1 fig., 1942. [English summary. Received June, 1944.]

Heterosporium echinulatum [*Didymellina dianthi*] was observed, for the first time in Argentina, attacking glasshouse carnations [*R.A.M.*, x, p. 297; xvi, p. 506] in Buenos Aires in July, 1940, and has since been recorded from other localities in the same Province. The fungus produces on the leaves, skin, and calyx, pale ochraceous spots surrounded by a blackish-purple to dusky violet halo (Ridgway). The echinulate, subcylindrical, bi-to-quadriseptate, brown-olive spores are borne on erect, slender, septate, nodose conidiophores and measure on an average 27 to 60 by 9 to 12 (average 42·3 by 14·7)μ. Inoculation experiments with pure cultures from potato dextrose, maize meal, or oatmeal agar gave positive results only in an atmosphere saturated with moisture.

MIDDLETON (J. T.), TUCKER (C. M.), & TOMPKINS (C. M.). **A disease of Gloxinia caused by Phytophthora cryptogea.**—*J. agric. Res.*, lxviii, 11, pp. 405–413, 4 figs., 1944.

This is a full account of the disease of glasshouse *Gloxinia* (*Sinningia speciosa*) due to *Phytophthora cryptogea* in California, a preliminary description of which has already been noticed [*R.A.M.*, xviii, p. 316]. The disease is stated to be of economic importance, causing a considerable loss of plants. A study of the causal fungus showed that the minimum temperature for mycelial growth is below 1° C., the optimum between 22° and 25°, and the maximum between 31° and 34°. All isolates of the fungus from *Gloxinia* proved pathogenic to healthy plants. The incubation period ranged from 14 to 28 days for seedlings, but all infected plants died within two to six days of commencing to wilt. For corms the incubation period was usually 18 to 35 days. Of 435 plants inoculated, none escaped infection, while all the controls remained healthy. The pathogen was re-isolated and proved pathogenic on re-testing. It was also able to infect a number of Gesneriaceae, and also *Cineraria* (*Senecio cruenta*), cockscomb (*Celosia argentea* var. *cristata*), and slipperwort (*Calceolaria crenatifolia*), besides 15 other newly reported hosts. Annual stock (*Matthiola incana* var. *annua*), *S. cruenta*, and Transvaal daisy (*Gerbera jamesoni* var. *transvaalensis*), are more susceptible to attack than China aster, *Celosia argentea* var. *cristata*, *Godetia*, *Gloxinia*, and *Calceolaria crenatiflora*. There was evidence that some isolates have a wider host range than others.

KREITLOW (K. W.) & MYERS (W. M.). **Prevalence and distribution of stripe smut of Poa pratensis in some pastures of Pennsylvania.**—*Phytopathology*, xxxiv, 4, pp. 411–415, 1944.

Stripe smut (*Ustilago striiformis*) was detected in amounts ranging from 0·5 to 11·4 per cent. in *Poa pratensis* plants in sod plugs collected from 13 representative Pennsylvanian pastures in 1942 [*R.A.M.*, xxiii, p. 110]. The plugs from each pasture were maintained separately and observed at intervals: in most lots there was an apparent increase in the incidence of infection, reaching a maximum of 34·4 per cent. of the plugs after five months and attributed to the development of symptoms among plants showing no sign of disease at the time of collection, and to the presence of the fungus in a dormant state. In some pastures infection was

fairly evenly distributed over the entire field, while in others the amounts varied in different areas.

MÜLLER (K. R.). **Zum Auftreten der Luzernewelke in der Provinz Sachsen.** [On the appearance of Lucerne wilt in the Province of Saxony.]—*Mitt. Landw., Berl.*, lviii, 32, p. 641, 1943.

A species of *Fusarium* is reported from 11 out of the 28 districts of Saxony administered by the Halle Plant Protection Station to be causing severe damage to the valuable lucerne crop, up to 80 per cent. of the fields inspected being involved and containing up to 50 per cent. diseased plants. The symptoms of the wilt are identical with those attributed in the United States to *F. oxysporum* var. *medicaginis* [*R.A.M.*, viii, p. 247; ix, p. 531].

PLANK (R.). **Zur Theorie von Kaltlagerkrankheiten von Früchten.** [A contribution to the theory of cold storage diseases of fruits.]—*Planta*, xxxiii, 5, pp. 728–730, 3 graphs, 1943.

In a previous paper the writer expounded his theory of the pathological phenomena associated with the cold storage of fruits sensitive to low temperatures [*R.A.M.*, xxii, p. 69]. The observed facts that the percentage of diseased fruits first increases with falling storage temperatures, reaches a maximum, and then declines as the atmosphere becomes still colder, are explicable on the basis of a disturbance in the normal biochemical processes due to the variable degree of delay in concatenated chemical reactions (cell toxin production and respiration) in the lower temperature ranges. The case of physiological breakdown in Monarch plums described by W. H. Smith from England [ibid., xix, p. 105], though more complicated, is not irreconcilable with the hypothesis here presented.

REEVES (E. L.). **Virus diseases of fruit trees in Washington.**—*Bull. Wash. St. Dep. Agric.* 1, 25 pp., 19 figs. (12 col.), 1943.

This is a summary of all available knowledge on the virus diseases of fruit trees in Washington, based on investigations and data obtained during the past ten years. Symptoms are described in popular terms and illustrated, and notes are given on control of the following diseases: mottle leaf, rusty mottle, twisted leaf, and rasp leaf of sweet cherry; pink fruit of sour cherry; western X-disease and wart of peaches; ring pox or ring spot of apricots; stony pit of pears; and mosaic of apples. Descriptions are also given of some disorders of unknown origin, often confused with virus diseases, such as crinkle and deep suture of sweet cherries and others.

The control recommendations given are admittedly tentative. No virus disease of fruit trees has been completely eradicated by tree-removal methods, but several outstanding examples are known from other States of effective economic control achieved by these methods. The success of the control programme rests upon repeated seasonal inspections, the recognition of the disease from visible symptoms, and the immediate removal of all possible sources of infection. By prompt removal and replanting of trees found affected with peach yellows, orchards have been saved for commercial production, while it is known that in the past, failure to apply these measures has often resulted in the final destruction of the whole planting. The practical value of the tree-removal method ultimately depends on such factors as the number of infected plants involved, host reservoirs of the disease, the rate of spread, and many other economic considerations. With regard to western X-disease of peach, it is pointed out that there is as yet no evidence of a definite relationship between the spread of this disease and the occurrence of the western species of chokecherry (*Prunus virginiana* var. *demissa*). The use of varieties tolerant of viruses is recommended only for certain diseases and under certain conditions, as

they represent a potential source of infection. The Lambert cherry, tolerant of mottle leaf, proved capable of producing good commercial crops in certain foothills and canyon districts of north-central Washington, where the Bing variety was seriously affected; the Bartlett pear was found to be tolerant of the stony pit virus.

COE (D. M.). **Report of the 1942 stone fruit virus disease survey in Washington.**—*Bull. Wash. St. Dep. Agric.* 2, 19 pp., 1 graph, 2 maps, 1943.

The stone fruit virus disease [see preceding abstract] survey conducted by the Washington State Department of Agriculture during the summer of 1942 covered a total of 160,223 sweet cherry trees on 1,062 properties, 17,117 sour cherry trees on 50, and 460,071 peach trees on 829. A total of 8,830 (5·5 per cent.) of the sweet cherries was found to be diseased; of these, 1,963 had mottle leaf, 341 rusty mottle, and 6,526 crinkle and deep suture. A total of 360 (2 per cent.) of the sour cherries had pink fruit, and 8,286 (1·8 per cent.) of the peach trees had western X-disease. Twisted leaf, a virus disease of sweet cherries, was reported for the first time in the State.

The survey established a low average percentage of infection for the whole of the State, but losses were more considerable in particular orchards or zones. Loss of commercial production increases progressively with the length of time a tree has been affected. The relationship of crop loss to percentage infection in any orchard varies with the specific disease present. Thus, sweet cherry orchards with 10 per cent. mottle leaf or rusty mottle are likely to sustain a greater reduction in yield than those with the corresponding amount of crinkle or deep suture. The greatest loss to the industry occurs through the spread of virus diseases, which renders an increasing number of trees unprofitable. This spread may be rapid, and is in some cases influenced by the prevalence of wild hosts in the neighbourhood. Thus, a greater incidence of mottle leaf was noticed in sweet cherry orchards close to the wild bitter cherry. Western X-disease was observed to spread more rapidly in some orchards than in others. The spread of these diseases is also probably influenced by the seasonal abundance of their as yet unknown vectors. At the present level of virus disease infection in most of the State, the removal of diseased trees and their replacement with young, healthy ones is considered both practical and advisable. Even in orchards where disease incidence is much higher than the average and the removal of trees presents a more difficult problem, it is thought that the large initial loss of trees for a few years following tree removal is preferable to the gradually increasing losses from year to year which would occur if no measures were applied. Great care should be taken to select healthy budding or grafting wood, eliminating all with masked symptoms, as the use of buds from such tolerant trees has, in many cases, been responsible for establishing infections in disease-free orchards.

CARRERA (C. J. M.). **Especies de Fusarium que causan podredumbre en los frutos de carozo.** [Species of *Fusarium* which cause decay of stone fruits.]—*Lilloa Rev. Bot. Tucumán*, v, 2, pp. 169–180, 3 pl., 1940. [German summary. Received June, 1944.]

Following a survey of previous investigations in the United States and Europe on the decay of stone fruits by *Fusarium* spp., the author describes his inoculation experiments with cultures of *F. solani*, *F. avenaceum*, *F. orthoceras*, *F. poae*, and *F. lateritium* [source not stated] on peach, cherry, plum, and apricot, the type of rot induced by each species on the several fruits being shown in tabular form.

Another object of the study was the determination of the enzymatic properties of the various species, which were as follows: *F. poae* secretes emulsin and protease; *F. solani* peroxidase, amylase, pectinase, lipase, and protease; *F. avenaceum* amylase, pectinase, and protease; *F. orthoceras* peroxidase, amylase, pectinase,

emulsin, and protease; and *F. lateritium* lipase and protease. At the end of 80 days all the species were found to have liquefied the gelatine in the bean and potato decoctions to a depth of at least 25 mm.

GREEN (D. E.). **Weather injuries to fruit.**—*J.R. hort. Soc.*, lxix, 6, pp. 175–178, 4 figs. (3 between pp. xxxiv and xxxv), 1944.

Some typical symptoms of certain injuries to fruit trees resulting from adverse climatic conditions in Great Britain are described, namely, frost damage to apple bark, apple and stone fruit blossoms, and apple fruits; sun scald of apple and stone fruits, including plums, the Cox's Emperor variety of which was affected in Surrey, Kent, and Worcestershire in 1943; and hail injury to apples and plums.

SINGH (U. B.). **Control of fruit diseases in Kumaun.**—*Indian Fmg*, iv, 8, pp. 411–412, 1943.

In these notes on fruit diseases at Kumaun, United Provinces, India, the author states that over 60 per cent. of the apple trees are affected by stem-black (*Coniothecium chomatosporum*) [*R.A.M.*, xxi, p. 531]. The fungus usually kills the thick branches, and as infection is present in all the local orchards, the loss suffered by growers must be considerable. The disease appears towards the middle of July and reaches its maximum virulence by the middle of August. It always starts from pruned surfaces and spreads downwards, producing a jet-black streak; this slowly extends and surrounds the entire branch, which cankers and dies. Stem-brown disease (*Botryosphaeria ribis*) [loc. cit.] affects 10 to 15 per cent. of apple twigs and stems. As both fungi remain hidden in the tissues, surface spraying and dusting are ineffective. Careful pruning of the affected parts at least 6 in. from the last point of infection is the only way to control these diseases once they have become established. Prevention consists in painting every cut surface with a paste made of red lead and copper carbonate in lanoline (2 : 2 : 2½ oz.).

Pink disease (*Corticium salmonicolor*) attacks the thick branches of apples, pears, and apricots. The commonest seat of infection is the fork of the branches, but the disease sometimes starts from cut surfaces also. Spread largely depends on conditions of shade and moisture, and the fungus is not virulent at the beginning of September. The following control measures are recommended: (1) painting the cut surface with the red lead, copper carbonate, and lanoline mixture; (2) painting the fork of the trees with red lead and copper carbonate in raw linseed oil (2 : 2 : 2½ oz.) before the monsoon; (3) cutting away affected branches 2 ft. below the edge of infection and burning them; (4) avoiding loamy and sandy soils for planting.

Sooty blotch and fly speck of apples (*Leptothyrium pomi*) [ibid., xxi, p. 145] may be controlled by (1) spraying with lime-sulphur (1 to 40) at open cluster stage, at petal-fall, at fruit formation, and again at fruit maturity; (2) thinning so as to leave two fruits per cu. ft. of the volume of the tree; (3) dipping the picked fruits for one minute in a 5 per cent. solution of bleaching powder or a 3 per cent. solution of sodium chlorate and then drying in air for 10 minutes, washing in tap water, and drying.

Directions are also given for the control of the storage soft rot of apples caused by *Penicillium expansum* [ibid., xxi, p. 458].

Sun scald of the trunk and branches of peaches, apricots, plums, and chestnuts produces deep longitudinal cankers. It can be controlled by tying straw round the parts affected, or likely to become affected.

DUNEGAN (J. C.). **Further results with metal dialkyl dithiocarbamates for the control of Apple blotch fungus.**—*Plant Dis. Reptr*, xxviii, 4–5, pp. 162–163, 1944. [Mimeographed.]

The spraying of Ben Davis apple trees near Fayetteville, Arkansas, seven times

during 1943 with ferric dimethyl dithiocarbamate, or lead dimethyl dithiocarbamate, at the rate of 2 lb. to 100 gals. in both cases, again resulted in satisfactory control of apple blotch (*Phyllosticta solitaria*) [*R.A.M.*, xxii, p. 488], the percentage of infected fruit in the sprayed blocks (four to each treatment) amounting to 0·2, 4·5, 0·1, and 0·07 and 4·3, 1·8, 0·2, and 0·1, respectively, compared with 39·6, 40·7, 3·1, and 9·9, in the controls.

SMITH (M. A.). **Blister spot, a bacterial disease of Apple.**—*J. agric. Res.*, lxviii, 7, pp. 269–298, 6 figs., 1944.

This is the account of a detailed study of blister spot disease of apples, first discovered in Missouri in 1916, later attributed to *Pseudomonas papulans* [*R.A.M.*, xiii, p. 384], and since found in Arkansas, Indiana, Pennsylvania, Virginia, and Illinois, but nowhere outside the United States. Under natural conditions the disease was found only on apple fruits, causing, in early June, a blister spot surrounded by a water-soaked area, often around the lenticels. The lesion is at first light in colour and may extend 0·2 to 0·4 mm. below the cuticle. Immediately below the lesion a phellogen layer, from three to five cells thick, develops. The bacteria are present throughout the region of papules. The disease is most conspicuous at this early stage and may be confused by the unaided eye with the minute infections caused by *Venturia inaequalis*. Later, the epidermis over the blister spot becomes dark and dies and often cracks loose from the surrounding healthy tissue. Although an apparent increase in the number of varieties affected was observed during the last two years in Missouri, suggesting a possible increase in severity of infection at some future time, at present the disease is considered to be of minor importance and the causal organism a weak parasite.

Positive results were obtained in inoculations of wounded and unwounded immature apple fruits in the field; of wounded immature apple, plum, cherry, and tomato fruits in moist chambers, twigs of apple, cherry, pear, plum, and lilac, and leaves of apple, peach, magnolia, and lilac. Needle-puncture inoculations of apple fruits and twigs with the lilac blight organism, *Phytomonas* [*Pseudomonas*] *syringae* [ibid., xiv, p. 319], were successful. An isolate from an undescribed leaf spot of ×*Magnolia soulangeana* proved pathogenic to apple fruits and twigs and to lilac and magnolia leaves. Negative results were obtained in apple fruits and twigs inoculated with two isolates from target canker of apple, and in apple leaves, twigs, and fruits inoculated with an isolate from an undescribed leaf spot of Rome Beauty apples.

The blister-spot organism was found incapable of survival on apple fruits placed outdoors after 15th March, indicating that blister spots on overwintered fruits are unlikely to constitute a source of infection in the spring.

A morphological and physiological study of 18 isolates of the blister spot bacterium, three of *P. syringae*, two from apple target cankers, one from *Magnolia*, and one from Rome Beauty apples revealed a close resemblance between the first two organisms and the *Magnolia* isolates, while the others appeared to be unrelated organisms. These observations were further substantiated by the results of a study of the cultural characters of the various isolates on solid and liquid media, and of their biochemical reactions and fermentation ability, using 31 carbon sources.

It is concluded that the blister spot organism, because of its morphological, cultural, physiological, and pathogenic similarity to *P. syringae*, should not retain specific rank, but be considered a variety of this species. It is designated *Phytomonas* (or *Pseudomonas*) *syringae papulans* n. var. and an emended technical description [in English only] is given. The isolate from magnolia is considered to be *P. syringae* and accordingly magnolia is regarded as an additional host of this pathogen.

Wilcox (R. B.). **Fermate spray for controlling Cranberry field rots.**—*Plant Dis. Reptr*, xxviii, 1, pp. 34–35, 1944. [Mimeographed.]

In preliminary tests carried out in New Jersey in 1943, cranberry plots were sprayed with fermate, 3 lb. per 100 gals., at the rate of 300 gals. per acre, five times during the summer at fortnightly intervals, except for the last application, which was delayed for another week. This treatment gave a highly significant reduction in the amount of field rot (known to be chiefly caused by *Guignardia vaccinii* and *Acanthorhynchus vaccinii*) [*R.A.M.*, xv, p. 817] and a similarly significant increase in the yield of sound fruit. The respective figures were 5·13 per cent. rotten berries and 51·7 barrels per acre of sound fruit harvested for fermate-sprayed plots as against 89·53 per cent. and 4·3 barrels per acre for the unsprayed, and 58·36 per cent. and 18 barrels per acre for those sprayed with Bordeaux (4–4–50). Spraying with Bordeaux thus gave approximately 35 per cent. control of field rot, while fermate gave 94 per cent. It is stated that Bordeaux is generally effective only under conditions of a light or moderate spore load, and that in New Jersey bogs, where the spore load is frequently excessive, the first-season spraying with Bordeaux is found merely to reduce the rot, full control being achieved only after two or three successive seasons of treatment, or in certain places never. In the present trials, plant growth at the end of the season was better in plots sprayed with fermate than in those sprayed with Bordeaux, and the fruit was definitely larger in the former. Further advantages of fermate were absence of blossom damage from spraying in full bloom and even increased set of fruit, and complete absence of visible residue on the harvested fruit.

Darrow (G. M.), Wilcox (R. B.), & Beckwith (C. S.). **Blueberry growing.**—*Fmrs' Bull. U.S. Dep. Agric.* 1951, ii+38 pp., 22 figs., 1 map, 1944.

In the section of this bulletin (pp. 29–38) dealing with diseases and pests of cultivated blueberries (*Vaccinium* spp.) in the United States, brief, popular notes are given on the symptoms and control of stunt [*R.A.M.*, xxi, p. 496], mummy berry (*Sclerotinia vaccinii*) [cf. ibid., iv, p. 610], twig blight (*Phomopsis vaccinii*) [ibid., xix, p. 550; xxii, p. 489], stem canker (*Physalospora corticis*) [ibid., xxii, p. 214], powdery mildew (*Microsphaera alni*) [ibid., xxii, p. 489], and 'double spot', a serious leaf disease of fungal origin, the exact cause of which has not yet been determined.

Lucas (G. B.), Chilton (S. J. P.), & Edgerton (C. W.). **Genetics of Glomerella. I. Studies on the behavior of certain strains.**—*Amer. J. Bot.*, xxxi, 4, pp. 229–233, 21 figs., 1944.

In this study of ascogenous cultures of unidentified species of *Glomerella* [*R.A.M.*, xxi, pp. 145, 425] from five different hosts (an unidentified wild species of *Ipomoea*, *Hibiscus esculentus*, *Pueraria thunbergiana*, chilli, and apple), carried out at Baton Rouge, Louisiana, from 1940 to 1943, the minus strain of each culture was easily obtained by isolating ascospores. A large number of ascospore isolations of the plus strain (the one commonly obtained in culture) developed into strains different from either the plus or the minus. Thus, from a single ascospore culture originally isolated from *Ipomoea*, seven distinct strains including the ordinary plus and minus of Edgerton, were obtained. Furthermore, in some of the original cultures from different hosts sectors occasionally developed which were similar to some of these new strains. Some of the sector strains differed from the parent in regard to the presence or absence of perithecia, normal ascospores, and conidia, and also in the shape of the conidia. The new strains are named the new plus, with fewer and smaller perithecial clumps, the fertile minus, differing from the minus in the production of numerous asci and ascospores, the heavy conidial, the small conidial, and the sterile. In making ascospore isolations of the plus strain it was

found that an ascus usually contains either four ascospores of the plus and four of the minus strain or else eight of the minus strain. There was some evidence that the asci in a single perithecium are usually alike in regard to the ratio of the different strains in an ascus, indicating that the constitution of an ascus is usually determined early and prior to the formation of ascogenous hyphae. From ascospore isolations of the minus strain, only colonies of the minus strain were obtained; and from those of the fertile minus, only such of the fertile minus. When planted in the same plate, a ridge of well-developed perithecia formed very rapidly on the line of contact between the plus and the minus, and between the plus and the fertile minus strains; and slowly with some of the other combinations. However, no such ridge developed when the strains came from different hosts.

FREAR (D. E. H.). **Deposition and retention of sprays. III. Apparatus and methods for laboratory spraying.**—*Bull. Pa St. Coll.* 463, 18 pp., 3 figs., 1 diag., 7 graphs, 1944.

A description is given of an apparatus for laboratory studies of the deposition and retention of sprays [*R.A.M.*, xxiii, p. 70], constructed, and now in use, at the Pennsylvania State College as a result of trials by a number of workers over a period of about eight years. It consists of a motor-driven rotating circular turntable connected with an atomizer type of sprayer fitted with an overhead reservoir containing the spray suspension. The synthetic surfaces to be tested (cellulose nitrate sheets, commercially available as Pyralin, proved the most suitable) are attached to the turntable, sprayed for a required length of time, dried, removed, and the deposit analysed. When a series of Pyralin plates were sprayed at different air pressures with a suspension of 3 lb. of Bordeaux per 100 gals. for three revolutions of the turntable, it was found that the amount of toxicant deposited on the plates increased steadily up to and including 80 lb. per sq. in. air pressure, and then decreased at 100 lb. pressure. Consequently, 80 lb. pressure was selected as standard for all later experiments. Increases in concentration of the spray were followed by consistent increases in the amounts deposited, although the response was not linear. Using the revolutions of the turntable as a measure of time, it was shown that the amount of deposit increased regularly up to six revolutions, after which the droplets grow so large that they run off, and beyond this point the amount of deposit becomes variable. To study the retention of spray, Pyralin plates may be sprayed with the desired concentration, allowed to dry, then sprayed and washed with water, and analysed.

MILES (H. W.). **A national advisory service for agriculture and horticulture.**—*Nature, Lond.*, cliii, 3890, pp. 611–613, 1944.

The author discusses the findings and proposals contained in the report of the Luxmoore Committee [*R.A.M.*, xxii, p. 208], appointed in 1941 'to examine the present system of agricultural education in England and Wales, and to make recommendations for improving and developing it after the war', and mentions some of the criticisms advanced at a recent meeting of the Association of Applied Biology, where the report received critical examination.

HAENSELER (C. M.). **Standardization of plant disease surveys.**—*Plant Dis. Reptr*, xxviii, 2, pp. 38–41, 1944. [Mimeographed.]

In this paper, read at a Round Table Conference sponsored by the 'Plant Disease Survey Sub-Committee' and held at the Columbus (Ohio) meeting of the American Phytopathological Society in December, 1943, the author proposes that plant disease surveys should be made with some specific objective in mind rather than in a random, general manner; that a survey method should be selected adapted to the specific problem in hand; that a sufficiently large area should be

surveyed to make correlation and interpretation of the data possible; and that estimates of crop losses should be expressed in terms of disease incidence and effect on crop yield or quality rather than of money. It is suggested that survey methods should be tested co-operatively, as in England [*R.A.M.*, xxii, p. 365], by several workers, before any is adopted as the official standard method. The adoption of official standard methods would greatly increase the value of the survey data obtained.

HELLYER (A. G. L.). **Garden pest control.**—120 pp., 31 pl., London, W. H. & L. Collingridge, Ltd., 1944. 7*s*. 6*d*. net.

This is a useful, popular book on the pests and diseases of garden crops. The first section is a general survey of the situation; the second lists the foes under their common names, with notes on symptoms, hosts, and control; the third tabulates the host plants with symptoms for identifying the pathogen; the fourth gives plant-protectives with directions for use; the fifth comprises a calendar of control measures; and a final section consists of 165 photographic illustrations to assist diagnosis.

RAMSBOTTOM (J.). **Fungi and modern affairs.**—*Nature, Lond.*, cliii, 3891, pp. 636–641, 1944.

This paper represents the substance of three lectures delivered by the author at the Royal Institution on 15th, 22nd, and 29th February, 1944. In a stimulating and comprehensive manner the author covers the entire field of applied mycology, dwelling on the importance of fungi in food economy, crop production, building and housing, medicine, and industry [cf. *R.A.M.*, xvi, p. 112].

SNOW (D.), CRICHTON (M. H. G.), & WRIGHT (N. C.). **Mould deterioration of feeding stuffs in relation to humidity of storage. Part I. The growth of moulds at low humidities. Part II. The water up-take of feeding stuffs at different humidities.**—*Ann. appl. Biol.*, xxxi, 2, pp. 102–110; 111–116, 1 pl., 11 graphs, 1944.

In the first of these papers, a full account is given of an experiment in which observations were made on the development of mould growth on linseed cake, bone meal, oats, Scotch beans, bran, and locust beans [*Ceratonia siliqua*] stored for periods extending over about 3½ years in order to determine the relationship between humidity, moisture content, and the onset of moulding. The materials were spread in thin layers in small Petri dishes placed on glass tripods and were exposed in separate ground-glass stoppered museum jars sealed with vaseline to atmospheres ranging from 100 to 60 per cent. relative humidity. Humidity was controlled by sulphuric acid solutions, the specific gravity of which remained unchanged. All samples were stored at laboratory temperature. The temperature variations never exceeded 10° C. The dishes were weighed daily until the moisture content–relative humidity equilibrium was established, and examined periodically for mould mycelium and mould fructification. The number of days before the development of these stages of deterioration was rated for each sample stored at the different humidities.

The data obtained showed that the main factors controlling mould growth were the relative humidity rather than the moisture content of the feed, length of storage period, balance and type of nutrients in the food, storage temperature, and type of mould present. Mould growth took place relatively quickly on all feeds stored at 100 to 75 per cent. relative humidity. Below 75 per cent. r.h. mould growth developed only after a very prolonged latent period. Mould development was observed on locust beans exposed to a humidity as low as 65 per cent. after a latent period of more than two years. The balance and type of nutrients provided by the feeds were found to influence both the latent period and the extent of mould

deterioration. Mould growth developed earlier on samples stored at 22° than on others stored at 15·5°. At high humidities all mould species grew rapidly, whereas at low ones only a few were capable of growth. *Aspergillus repens* was the most ubiquitous species, and was able to germinate on some materials at r.h. 67.

In the second paper details are given of an investigation of the water uptake of a wide range of feeding stuffs corresponding to a range of fixed humidities. From the data obtained, the maximum moisture content for the safe storage of each individual feed was calculated. The samples were exposed to a range of humidities between 40 and 100 per cent. and were weighed daily until equilibrium had been established. Equilibrium was obtained with all samples except those exposed to 90 and 100 per cent. r.h., in which moulding intervened.

It was ascertained that the level and shape of the water curves were closely related to the amounts of soluble carbohydrate and protein present. Fibre had a depressing effect on water uptake, the value for which was also reduced by the presence of inert fats and non-hygroscopic ash constituents.

The results of these tests have made it possible to lay down safe limits of percentage water content for both short and long period storage, below which mould growth will not normally occur. These limits vary for each individual material; taken in categories, they are, for short and long periods, respectively: cereals and their by-products, 14·4 to 15·7 and 12·8 to 14·6; legumes (peas and various beans), 13·3 to 15·1 and 11·3 to 13·7; oil cakes, 11·5 to 15·1 and 11·3 to 13·3; miscellaneous feeds, including straw, hay, blood fibrinogen, fish and bone meals, 9·5 (bone meal) to 15·3 (malt culms) and 8·4 (bone meal) to 12·9 (blood fibrinogen). Details are given in tabular form.

Leviton (A.). **A simplified laboratory check valve and its application in the construction of anaerobic culture tubes.**—*Science*, N.S., xcix, 2579, pp. 455–456, 1 fig., 1944.

The author describes an inexpensive and easily assembled check valve for anaerobic culture tubes, consisting, briefly, in a cotton or glass wool plug fitted into a constriction near the mouth of the tube, mercury being floated over this plug to a depth of at least $\frac{1}{4}$ in., and a second cotton plug inserted above the mercury to prevent spattering. The valve will not permit the passage of air into the tube, but will relieve the slightest pressure of gas within. The tubes have a narrower side-arm bent at right angles and provided with a second check valve. Inert gas can be introduced through the smaller tube and allowed to escape through the main valve.

Baker (Gladys E.). **Nuclear behavior in relation to culture methods for Penicillium notatum Westling.**—*Science*, N.S., xcix, 2578, p. 436, 1944.

This is a preliminary note on the results of a cytological study of *Penicillium notatum*, a full account of which is expected to appear shortly in *Bull. Torrey bot. Cl.* The conidia of the fungus were found to be predominantly uninucleate and only occasionally binucleate. It is argued that if a spore is heterotypic, then the genetic means of variation are present from the start, and if it is homotypic, the line can be developed monotypically provided no mutations occur. In mass spore transfers a few hours after germination there is marked anastomosis among the developing germ-tubes, conidia, and mycelia, giving abundant opportunity for nuclear interchange with resulting heterocaryotic vigour. As the analysis of cultural isolates indicates that the variations are due to a mixture of genetic factors following anastomosis and consequent heterocaryosis, it is considered that at present mass spore transfer methods offer as good a way as any of keeping cultures active.

Roy (B. S.) & Ray (J. N.). **Recovery of agar from used media.**—*Curr. Sci.*, xiii, 4, pp. 98–99, 1944.

Details are given of a procedure for the recovery of used agar media from vaccine bottles. After autoclaving, the agar was filtered hot through muslin, allowed to gel, left covered with water overnight, broken into small pieces, and washed repeatedly until giving no turbidity with ferric chloride, indicating freedom from growth inhibitory substances. The washed agar was either used immediately or dried. The recovery was about 50 per cent.

Food yeast. A venture in practical nutrition.—29 pp., 4 diags., London, Colonial Food Yeast Ltd., 1944. 2*s*. 6*d*.

This booklet, prefaced by the Secretary of State for the Colonies, explains the origin and the function of Colonial Food Yeast Ltd., a Government undertaking sponsored by the Colonial Office and financed under the Colonial Development and Welfare Act, 1940. The Company has a factory in Jamaica, where the food yeast (dried *Torulopsis utilis*) [cf. *R.A.M.*, xxiii, p. 72] is produced. The product contains highly nutritive proteins and vitamins of the B complex and is expected to provide a cheap foodstuff much needed by Colonial people. The production is based on improved methods evolved at the Chemical Research Laboratory of the Department of Scientific and Industrial Research at Teddington under the direction of A. C. Thaysen, who describes them in Part III of this booklet. Other chapters are devoted to the nutritional and the commercial aspects of the problem. Appended are a table of comparative nutritional values of food yeasts and other foodstuffs; a table of the growth rates and nutritional requirements of *T. utilis*; diagrams of laboratory type glass growth unit, of the semi-technical scale plant, of the yeast seed vessel, and a flow diagram of the yeast factory.

Sperber (E.). **Torulopsis utilis and the citric acid cycle.**—*Nature, Lond.*, cliv, 3899, pp. 116–117, 1944.

This is an account of a cultural study on *Torulopsis utilis* [see preceding abstract], conducted at the Wenner-Gren Institute for Experimental Biology, University of Stockholm. It was found that *T. utilis* grown on ethyl alcohol could not utilize succinic acid but that it could be adapted rather easily to that substance in the presence of ammonia and its salts, and with much difficulty to malic, fumaric, or citric acid. After twice culturing on succinic acid, the yeast was able to attack all the four acids mentioned.

Proskauer (R.). **Fungus-proofing procedure.**—*Electronics, 1944*, pp. 92, 93, 224, 229, 232, 4 figs., 1944.

Electronic equipment frequently fails in the tropics, where the high relative humidity permits the ingress of moulds constituting a serious source of leakage. Of the 29 fungicides tested for the control of these organisms, as well as for heat stability, wet and dry dielectric strength, and corrosive effect in aqueous and lacquer media on panels of copper, low-carbon steel, cadmium-plated and silver-plated steel, and two aluminium alloys, and on rubber, neoprene, and other materials used in completed communications apparatus, an organic mercury salt appeared to be the most promising. Among the components for which protection is required are paper and metal-case capacitors, transformers, cotton-braided wire, and moulded- and laminated-phenolic parts.

Samsonova (Mme O. A.). **Free copper compounds in fabrics that have been impregnated to prevent decay.**—*Tekst. Prom., 1943*, 1–2, pp. 15–18, 1943. [Russian. Abs. in *Chem. Abstr.*, xxxviii, 5, pp. 1120–1121, 1944.]

Fabrics impregnated against decay may contain copper and chromium tannates,

aluminium soaps, aluminium and iron tannates, and copper soap [*R.A.M.*, xxiii, p. 266]. Moreover, since the protective treatment is followed by a neutralizing bath in a sodium carbonate solution, opportunity is afforded for the formation of aluminium hydroxide and malachite. The formation of copper compounds was investigated, the following mixtures being prepared: (1) tannins, copper sulphate, and dichromate, (2) copper soap, (3) solutions of soap, tannins, copper sulphate, and dichromate, (4) malachite, and (5) solutions of copper sulphate, dichromate, and sodium carbonate. The reaction between the tannins and copper sulphate proceeds slowly and does not reach completion, whereas dichromate reacts fully. The reaction between copper sulphate and sodium carbonate proceeds rapidly and practically completely. When two baths are used, copper may form tannates, soap, and basic carbonate, of which the first two are not stable to water extraction, while the third is. Copper compounds are extracted with boiling water because of the instability of copper tannates and soap and of combinations of copper and linen fibre. Therefore, the greater the copper content in the fabrics, the more 'free copper compounds' may appear. This is of interest in connexion with estimations of the strength and durability of the material, to which the presence of a large quantity of fixed copper contributes.

Stevens (W. H.). **Applications of chlorinated phenols.**—*Chem. & Indust., 1944*, 19, p. 176, 1944.

Chlorphenols have wide and varied applications in the field of industrial preservation, being suitable, for instance, for the treatment of wood, leather [see next abstracts], cellulosic products, textiles [*R.A.M.*, xxiii, p. 71], proteins, starches and adhesive materials in general, rubber latex, and oils and paints [ibid., xxiii, p. 183]. For these and kindred purposes pentachlorophenol or its sodium salt are usually employed on account of their high degree of efficiency, accompanied by economy in use. Para-chlor-meta-cresol is also largely used for the preservation of proteins, gums, adhesives, and the like, while treatment with the tar acids themselves is likewise practicable where low cost is a determining factor.

The medicinal applications of the chlorphenols and the legal restrictions on their use are briefly discussed.

Lollar (R. M.). **Report on a study and the development of a mould-resistant treatment for leather. Report on mould-resistant treatments for leather.**—*J. Amer. Leath. Chem. Ass.*, xxxix, 1, pp. 12–24; 5, pp. 179–190, 1944.

A comprehensive, tabulated account is given of studies at the University of Cincinnati on the relative efficacy of a number of leather mould- and mildew-preventive agents, using as test organisms *Chaetomium globosum* and common species of *Penicillium* and *Aspergillus* [*R.A.M.*, xx, p. 304], and having special regard to the potential application of the chemicals by the Army in the tropics. The tests were carried out at a temperature of about 95° F. and 85 to 90 per cent. relative humidity, and the fungicides were incorporated into the vegetable-tanned samples from a solution or emulsion. Ethyl alcohol, Stoddard's solvent, carbon tetrachloride, and water were the solvents commonly used, while sulphated castor oil proved effective as an emulsifying agent. About half the weight of the solution was taken up by the leather during the three hours' drumming in distilled water to remove soluble substances which followed air-drying, and it was necessary to allow for this in calculating the amount of the active ingredient actually present.

The experimental results demonstrated the general efficiency for the object in view of salicylanilide, pentachlorophenol [see preceding abstract], penta-chloro-meta-xylenol, 2-mercaptobenzothiazole, 2,2′dichloro-5,5′ dihydroxy-diphenylmethane [cf. ibid., xxiii, p. 71], 2, 4, 5-trichlorophenol, tetrachlorophenol, and paranitrophenol. The minimum concentration of these compounds requisite to

confer protection is 0·25 per cent., so that a strength of 0·5 per cent. would in all probability be essential under the very exacting conditions likely to be encountered in tropical service.

Lollar (R. M.). **Report on toxicity studies on preservative bearing leather.**—*J. Amer. Leath. Chem. Ass.*, xxxix, 6, pp. 203–209, 1944.

The results of studies carried out on dogs and horses exposed to contact with preservative-bearing leather [see preceding and next abstracts] indicated that no adverse effects on the animals' health need be expected to follow the use of 0·25 to 5 per cent. pentachlorophenol, paranitrophenol, salicylanilide, chloro-symmetrical xylenol, 2, 4, 5-trichlorophenol, tetrachlorophenol, 2-mercaptobenzothiazole, 5, 5′ dihydroxydiphenylmethane, and mixtures thereof.

Greene (H. S.) & Lollar (R. M.). **Report on preservatives in Army dubbings.**—*J. Amer. Leath. Chem. Ass.*, xxxiv, 6, pp. 209–220, 1944.

Paranitrophenol, para-chloro-meta-xylenol, pentachlorophenol, and tetrachlorophenol were shown to be very effective against moulds and mildew (*Aspergillus* and *Penicillium* spp. and *Chaetomium globosum*) when incorporated into dubbing, especially for the protection of Army shoe upper leather [see preceding abstracts]. The mixture recommended consists of 0·8 per cent. each of paranitrophenol, para-chloro-meta-xylenol, and tetrachlorophenol; pentachlorophenol may be substituted for para-chloro-meta-xylenol if the latter is unobtainable. This formula preserved grain-finished samples for periods upwards of nine weeks and flesh-finished leather for five.

Schaede (R.). **Die Symbiose in den Wurzelknöllchen der Podocarpeen.** [Symbiosis in the root nodules of the Podocarpeae.]—*Planta*, xxxiii, 5, pp. 703–720, 9 figs., 1943.

Full particulars are given of the writer's studies at the University of Breslau on the nature of the symbiotic process in the root nodules of *Podocarpus chinensis* and *P. nubigena* [cf. *R.A.M.*, iii, p. 225]. The host cells were found to be occupied by a non-septate fungus, provisionally named mycelium *P*, forming in the cortex a loose coil of hyphae, 2 to 6 μ in diameter, with arbuscules, barely 1 μ in diameter, and so densely bunched as to resemble a 'witches' broom' or cauliflower head, and spherical or piriform, mostly terminal, occasionally lateral vesicles [cf. ibid., xviii, p. 468]. Eventually, the entire mycelium with the exception of the membranes and some of the vesicles, is ingested by the host. The detection of vesicles with their contents divided into a periplasm and a multinuclear ooplasm, evidently representing oogonia and sporangia, indicates that the fungus is a Phycomycete belonging to the Peronosporaceae and possibly a member of the Albugineae. The vesicles did not proceed to a reproductive phase; on the contrary, their contents gradually became homogenized and partially disappeared.

The root nodules do not arise in consequence of fungal infection, which only takes place at an advanced stage or the conclusion of their development, while some were free of any extraneous organism. The regular disintegration of the cortex in these bodies corresponds to the normal behaviour of the root cortex in certain Gymnosperms and has no connexion with symbiosis. Since the endophytic mycelium is only in very slight contact with the soil, there is no question of its acting as a channel of nutrient supply to the host. It is rather to be regarded as an innocuous parasite, the ingestion of which by the plants is a form of defence mechanism.

Invasion by the endophyte does not affect the size of the root nodule cells and only slightly increases their cytoplasm content. The nuclei are somewhat enlarged and their structure insignificantly coarsened. The plurinuclear condition, common

to infected and fungus-free cells, is a sequel to mitoses without subsequent cell division; these occur exclusively in uninvaded cells, which must therefore be occupied by several nuclei before the advent of the endophyte.

Neill (J. C.). **Rhizophagus in Citrus.**—*N.Z. J. Sci. Tech.*, A, xxv, 5, pp. 191–201, 7 figs., 1944.

Rhizophagus [*R.A.M.*, xviii, p. 470] was detected in the tertiary roots of 128 citrus trees, representing all the varieties grown in New Zealand, and in roots of the same host from three localities in Australia, Rarotonga (Cook Islands), and Riverside, California (sweet orange grafted on various rootstocks). Hyphae of the same organism, generally furnished with arbuscules and vesicles, were further detected in the roots of all local pip and stone fruits, nuts, berries, hedge and herbaceous plants, cereals, grasses, and weeds, as well as in those of native pines, broadleaf trees, shrubs, lilies, and ferns collected from primeval forests and heaths remote from human contact; it has not, however, been identified with certainty in the roots of exotic pines harbouring Basidiomycetous mycorrhizal fungi.

The hyphae of the endophyte are very variable in size, the main trunk branches attaining a maximum diameter of 15 μ and subsidiary ones a minimum of 2 μ. When forming part of a living mycelium the hyphae have thin, hyaline walls, the lumen filled with multinucleate protoplasm in constant 'streaming' motion. From such hyphae septa are absent, but on an encounter with unfavourable conditions, the protoplasmic contents appear to retract, leaving a residue of septum-like partitions cutting off the empty tube or even an entire mycelial complex. Such conditions commonly arise when an extraneous hypha penetrates a root, the portion external to which is cut off by one to several pseudo-septa at or near the point of ingress, and emptied of its protoplasmic contents, the walls becoming yellow and opaque. The most characteristic feature of the mycelium is the constant anastomosis of the hyphae, which sometimes results in the formation of a closed system of inter-communicating passages traversed by moving protoplasm.

Infection hyphae penetrate directly through an epidermal cell, an irregular, knot-like swelling being formed at the site of entry and often a contorted mass within the cell itself. As a rule, the hyphae then begin to ramify through the intercellular spaces, but sometimes direct cell penetration extends almost to the endoderm, which is, however, not actually invaded. The vesicular-arbuscular system of the endophyte has been adequately described by Butler [loc. cit.] and others.

The age and physiological state of the particular root among over 2,000 specimens examined appeared to be the governing factors in the relative abundance of *R.*, botanical differences in the host being apparently of little or no importance, at any rate in the five species of citrus investigated. Hyphae with vesicles predominate in semi-moribund rootlets. The cortex of feeding roots is occupied only at an early stage of growth by hyphae with arbuscules and vesicles, which disappear during the ensuing period of vigorous development. As the growth rate decreases, however, the intracortical hyphae increase and anastomose into a network of vesicles and arbuscules penetrating most of the adjacent cortical cells. Extracortical hyphae likewise proliferate, form fresh points of ingress, send out branches into the soil, and sometimes form anastomosing networks bearing vesicles, which in perennial plants gradually disappear. This process is not complete when growth recommences, at any rate in citrus, but reinfection seems to take place by the penetration of extraneous hyphae rather than from an elongation of the residual intracortical mycelium. At this juncture occasional stout hyphae of regular contour can be traced on a perpendicular course from the root epidermis into the soil; they probably arise from the deep-seated complex in the mature roots and penetrate the epidermis of the new ones as infection hyphae.

Notwithstanding repeated attempts, pure cultures of the citrus endophyte have

not yet been obtained. In the present studies, tertiary rootlets from seedlings grown in old beach sand were thoroughly washed, dried, and deeply planted in Petri dishes of soil-water agar. Very few of the hundreds of root sectors grown in this way remained free from a bacterial halo, and those that did so failed to develop further. At 21° C. the *R.* hyphae can normally be detected after 48 hours, and by the tenth day a length of 5 to 6 cm. is attained, after which growth ceases. Anastomosis between the lateral branches may occur, but no close mycelial mat is formed. No external development of the endophyte takes place from roots submerged in water, which are thick, unbranched, and completely unlike the normal ones produced in soil. Experimental evidence indicates that *R.* is neither harmful nor beneficial to its citrus hosts, no consistent differences having been observed at the end of six months between inoculated and non-inoculated grapefruit and *Citrus* [*Poncirus*] *trifoliata* plants, or after three months between the same two categories of sweet orange seedlings.

Like the grass endophytes [ibid., xxiii, p. 229], *R.* appears to have achieved a state of physiological balance with its hosts, neither enhancing nor reducing their general well-being, at any rate in the case of young plants. It is thus, in all probability, of little economic significance, but its taxonomic position raises problems of considerable interest, more especially in connexion with the apparent absence of a reproductive system, as ordinarily understood, and its origin in a period of remote antiquity.

Meyer (J. R.). **Experiências relativas à ação da tiamina (vitamina B) sobre a germinação e desenvolvimento de sementes de Orquídeas em meios assimbióticos. Meio assimbiótico simplificado para culturas de sementes de Orquídeas.** [Experiments on the action of thiamin (vitamin B) on the germination and development of Orchid seeds in asymbiotic media. A simplified asymbiotic medium for Orchid seed cultures.]—*Biológico*, ix, 12, pp. 401–406, 2 pl., 1943; x, 3, pp. 63–66, 1944.

In these experiments seeds of *Rodriguesia* sp., *Cattleya harrisoniae* [*C. loddigesii*], and other orchids were sown on Knudson's or a modified Sladen's medium in the absence of the symbionts [*R.A.M.*, xxii, p. 171] with and without thiamin (vitamin B_1). The thiamin series showed more rapid development of the foliage and root system than the controls, which remained stunted.

A number of species of orchids were grown on a medium consisting of 250 c.c. each of tomato juice and distilled water with 9 gm. chopped agar. Development of these seedlings was superior to that of the controls on standard media. In view of the results obtained in the thiamin experiments, the B_1 content of tomato may be significant.

Bawden (F. C.) & Sheffield (F[rances] M. L.). **The relationship of some viruses causing necrotic diseases of the Potato.**—*Ann. appl. Biol.*, xxxi, 1, pp. 33–40, 1 pl., 1944.

An examination of potato material containing potato virus B free from contamination with potato virus X showed that B is a strain of X [*R.A.M.*, xxii, p. 368]. No significant differences were found to exist between the properties of the two in sap from infected tobacco. Inoculation of tobacco leaves with virus B gave protection against virus X. Three other viruses, designated X^a, X^x, and X^y, were also demonstrated to be strains of virus X; differences between them could be shown by cross-absorption tests, but not by serological analysis. All these strains produced intracellular inclusions, varying with different hosts and virus strains, but generally, except for strain B, larger and more frequent in potato than in tobacco or tomato plants. All gave systemic infection when inoculated into tobacco, tomato, and potato varieties in which they are carried or cause mosaic symptoms; and some

when inoculated to varieties in which they produce top necrosis, while others caused only local lesions.

Potato virus C was shown to be a strain of Y. Similar symptoms were produced by both in tobacco and a few potato varieties, but in those varieties in which Y caused leaf-drop streak, C caused top necrosis. C produced systemic infection in tobacco and also in potato varieties in which it causes mosaic symptoms but not in those in which it causes top necrosis. Attempts to transmit virus C by *Myzus persicae* were unsuccessful.

Virus A is considered to be unrelated to either Y or X. A few small intracellular inclusions were found in tobacco and potato plants infected with either C or Y, but none in those infected with A.

In conclusion it is pointed out that symptomatology is not a reliable basis for classifying viruses, as related strains may produce widely different diseases in the same host, while unrelated viruses may cause identical symptoms.

SESSOUS (G.) & PIELEN (L.). **Versuche zur Einschränkung des durch Viruskrankheiten hervorgerufenen Abbaues der Kartoffel durch anbautechnische Massnahmen.** [Experiments in the reduction of Potato degeneration due to virus diseases by cultural methods.]—*J. Landw.*, lxxxix, 1, pp. 32–48, 5 figs., 1942. [Abs. in *Exp. Sta. Rec.*, xci, 1, p. 43, 1944.]

The writers' experiments were designed to determine the feasibility of directing cultural methods towards the reduction of potato 'degeneration' of virus origin in Germany, among the factors investigated being distance from infection foci and changes in planting and harvesting dates and in the direction of the rows [cf. *R.A.M.*, xxiii, p. 146]. The results of the studies indicated that, with increasing distance from the focus of infection, severe cases decreased fairly uniformly up to the tenth row. Early harvesting showed no more favourable results than late harvesting. The growth of a second crop favoured infection. The direction of planting caused considerable differences in the proportion of severe cases and in yield, ascribable only in part to wind velocity and direction.

HANSING (E. D.). **A study of the control of the yellow-dwarf disease of Potatoes.**—*Bull. Cornell agric. Exp. Sta.* 792, 28 pp., 3 graphs, 1943.

An abstract of the work described in detail in the present bulletin has already been noticed [*R.A.M.*, xxi, p. 264]. The following additional items of information are of interest. A survey of commercial potato fields in Steuben county, New York State, showed that the varieties Rural, Katahdin, and Chippewa averaged, respectively, 15·8, 0·14, and under 0·1 per cent. plants affected with yellow dwarf. The difference between the figures for Rural and either of the other varieties was highly significant. A medium to high percentage of infected plants occurred in all samples of Green Mountain potatoes for each planting date satisfactory for commercial production in western New York. There was little spread of yellow dwarf to Chippewa or Katahdin for any date of planting. The difference in the spread to Green Mountain and either of the other two varieties was highly significant. A medium to high current-season spread occurred in potatoes isolated in medium red, mammoth red, and alsike clover fields. A medium to high percentage of infected plants occurred in samples from potato plots isolated in lucerne, clover, meadow, oat, and maize fields. A potato plot isolated in a dense wood did not become infected. The average current-season spread to Green Mountain and Katahdin, isolated in clover, meadow, and lucerne fields, was 29·9 and 0·82 per cent., respectively, a highly significant difference.

In a greenhouse test, potato plants did not carry the virus through the second season without showing symptoms. Diagnosis by slicing half tubers, observing the number that presented spots, and multiplying by a factor (derived from indexing

comparisons) was found approximately to indicate the number of infected tubers. Diagnosis by inoculating leaves of *Nicotiana rustica* with the sap and ground tissues of tubers gave less accurate results.

SCHLUMBERGER (O.). **Die Zuverlässigkeit der Kartoffelkrebs-Prüfungen.** [The reliability of the Potato wart trials.]—*Forschungsdienst*, xvi, 5, pp. 215–220, 1943.

The discovery of new biotypes of the potato wart fungus (*Synchytrium endobioticum*), capable of causing severe local damage to certain approved varieties in Germany [*R.A.M.*, xxii, p. 273], has cast some doubt on the reliability of the official trials for immunity from disease. The phytopathological experts engaged in this work are, however, fully alive to this aspect of the problem, and the 'Giessübel' (Thuringia) physiologic race was included among the collections serving as inoculum for the 169 varieties comprised in the 'main' series of trials in 1942–3, i.e., those carried out at three stations on 50 tubers of each survivor of the preliminary tests with (*a*) one tuber and (*b*) 20 tubers each of varieties affording good prospective material for breeding. In view of these stringent precautions for the exclusion of susceptible strains among the authorized immune varieties, the likelihood of even a local outbreak of major dimensions appears remote.

TERVET (I. W.). **Alternaria tuber rot and other diseases on stored Potatoes in North Dakota.**—*Plant Dis. Reptr*, xxviii, 3, pp. 94–96, 1944. [Mimeographed.]

A survey of potatoes in storage in North Dakota showed dry rot (*Fusarium* sp.) to be the most widely spread and harmful disease.

Attack by *Alternaria solani* was unusually heavy in three localities, where infection was so severe that a few lots of Cobblers, Chippewas, and Red Warbas fell below certified seed grade standards, and the growers concerned suffered considerable losses. Triumphs were attacked only occasionally and never to such an extent as to affect the grading of the crop; no lesions were found on the Katahdins. Lesions on Cobblers were as large as 2 in. in diameter; many tubers had several small ones, $\frac{1}{4}$ to $\frac{1}{2}$ in. in diameter; not infrequently elongated, narrow lesions were seen, which seemed sometimes to follow cracks or cuts in the skin. Not all potatoes in the three districts were attacked, as fields of Cobblers situated near heavily infected ones of the same variety showed only slight infection. Vine infection was not more severe where tuber infection was heavy than where it was slight. The reasons for the serious occurrence of the disease in the three localities mentioned are as yet not fully understood.

GRANOVSKY (A. A.). **The value of DDT for the control of Potato insects.**—*Amer. Potato J.*, xxi, 4, pp. 89–91, 1944.

Preliminary field tests in Minnesota in 1943 indicated that the insecticide DDT possesses considerable fungicidal value, potato plots dusted with this material at a 5 per cent. level in Pyrax ABB showing less early and late blight [*Alternaria solani* and *Phytophthora infestans*, respectively] than plots treated with various fungicides commonly used in potato fields.

STÖRMER. **Massnahmen zur Gesundheitspflege bei Pflanzkartoffeln.** [Hygienic precautions for seed Potatoes.]—*Mitt. Landw., Berl.*, lviii, 25, pp. 475–478, 2 figs., 1943.

Irregularity in the emergence of potato seedlings, which is the rule rather than the exception in Germany, especially in the north-east, is attributable chiefly to infection by *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xxiii, p. 355]. This pathogen, which is responsible for much heavier damage than usually recognized, may be

effectively combated by the postponement of planting until the soil temperature reaches a maximum of 8° C., shallow planting, and the application to the soil of an active nitrogenous manure, preferably in the form of ammonium sulphate (2 doppelzentner [200 kg.] per ha.), placed directly in the plant holes immediately before or at planting. These practices are designed to expedite the formation of aerial leaf rosettes, at which stage sufficient resistance has been acquired to repel the parasite.

Some varieties, notably among the older types, are 100 per cent. infected by comparatively mild forms of mosaic, e.g., Erstling [Duke of York] with the X virus, Juli and Allerfrüheste Gelbe with A. These two viruses, as well as leaf roll and streak [potato virus Y], are harboured in a latent form by some of the varieties officially designated immune, and may cause severe injury under adverse weather conditions for the host. The inspection of stands with a view to the elimination of diseased plants should be made at an early date, before the combined effects of warmth and luxuriant growth have 'masked' the symptoms. Although the relatively weak viruses A and X do not cause the heavy losses associated with leaf roll and Y, they may reduce the yield by as much as 20 per cent., and are therefore not to be disregarded. The more serious leaf roll and Y are heavily penalized in stands submitted for seed certification, the standards for which are so high that they can only be reached by the utmost stringency in respect of virus exclusion. The detection of X presents considerable difficulty, and should never be attempted in bright sunlight; early morning and late afternoon are the more suitable times for a search for this virus, or a dull day may be chosen for the purpose. The peach aphid [*Myzus persicae*], largely responsible for potato virus transmission, prefers sheltered to exposed sites, hence it is advisable to choose the latter for potato fields. Excessive manuring should be avoided, since undue luxuriance of growth tends both to conceal the symptoms of infection and to attract the aphid vectors. Since there is a grave risk of virus spread from diseased to healthy neighbouring stands, a minimum distance of 20 m. is allowed by the latest regulations between a crop intended for certified seed and one with over 10 per cent. severe virus infection.

Another prevalent disease, especially on sandy soils, is black leg (*Bacterium phytophthorum*) [*Erwinia phytophthora*], which does not usually involve all the shoots on a given plant and may therefore be partially controlled by the timely removal of the infected ones before tuber formation. Another means of combating the pathogen consists in the excision of the hilum, through which infection enters the tuber. In general, the cutting of seed potatoes is not to be recommended, but where the practice is necessary, the knife should be plunged in a 10 per cent. formalin solution after each cut to prevent the transmission of *E. phytophthora*. Suberization of the cut surface occurs only in the presence of at least 80 per cent. atmospheric humidity, and the sterilized slices should therefore be planted immediately, or if this is impracticable, temporarily covered with damp sacking.

Two applications of 1·5 to 2 per cent. Bordeaux mixture should be made against late blight (*Phytophthora*) [*infestans*], the first just before flowering and the second a fortnight to three weeks later. The best results have been obtained by the 'Palatia' portable spraying machine (Platz, Ludwigshafen), with a capacity of 600 l. per hr., while Dr. Sack's apparatus is also effective and consumes only 200 to 250 l., but in this case a higher concentration of the fungicide (4 to 5 per cent.) is requisite.

BURGESS (A. H.), BEARD (F. H.), KEYWORTH (W. G.), & MASSEE (A. M.). **The problems and practice of Hop growing. The culture, drying, diseases and pests of the Hop.**—*J. Inst. Brew.*, N.S., xl, 3, pp. 118–139, 3 figs., 1943.

The information presented by W. G. Keyworth on the fungal and virus diseases of hops in England (pp. 128–135) has already been noticed in this *Review* from other sources.

Stevenson (E. C.). **Diseases of drug and related plants at the Plant Industry Station, Beltsville, Maryland, in 1943.**—*Plant Dis. Reptr*, xxvii, 25, pp. 700–703, 1943. [Mimeographed.]

In these notes on diseases of drug and related plants observed at Beltsville, Maryland, in 1943, it is stated that during the spring *Ricinus communis* seedlings became extensively affected by a disease involving the cotyledons or growing point, or both, and usually attacking the stem just below ground-level. Infection of the growing point in most cases proved fatal. A species of *Alternaria* was consistently isolated from the diseased tissue. In June, coriander showed localized infections at soil-level or at various heights along the stem. A lesion near the apex of the stem caused the tissue to collapse, with resulting production of a 'gooseneck' effect, the tissue above the lesion often remaining green and active. The leaves of some affected plants wilted and turned brown. A species of *Fusarium* was consistently isolated from tissue transplants, and *F.* spores developed on lesions in a damp chamber. Tobacco mosaic destroyed almost all the first-year planting of *Hyoscyamus niger* in 1942, but in 1943 the disease was less destructive on similar material. *Perilla frutescens* was affected by wilt. The stem showed a cortical rot at and immediately above soil level. The plants wilted, bent over at the top, and died. Apparently, the condition attacked small plants or caused stunting. A species of *F.* was repeatedly isolated from affected material. Towards the end of June, sage plants scattered about the field developed wilting of the outside branches. The cortex at and just above soil-level darkened and disintegrated. When the centre wilted, death ensued, but in other cases recovery seemed to occur. A species of *F.* was isolated from diseased material.

L. (H. M.). **The Sugar industry of Cuba.**—*Int. Sug. J.*, xlvi, 546, pp. 146–148, 1944.

The planting of the mosaic-susceptible sugar-cane variety Co. 213, imported into Cuba from Puerto Rico and introduced into the Santa Clara province in 1931 in an effort to replace the decadent Cristalina [*R.A.M.*, xxi, p. 98], was stated by J. G. Salinas at the 16th meeting of the Sugar-Cane Technologists of Cuba to have resulted in heavy financial losses. Co. 213 failed particularly in 1942, partly owing to the excessive rainfall during ripening, but the variety also suffers severe damage from the borer, *Diatrea saccharalis*. A change of variety is urgently called for, and the following are recommended: P.O.J. 2878 [loc. cit.], which is almost immune from mosaic, and Media Luna 3/18 (derived from P.O.J. 2878 and S.C. 12(4)), a heavy cropper and apparently immune from mosaic.

L. (H. M.). **Sugar cane investigations in Jamaica.**—*Int. Sug. J.*, xlvi, 548, pp. 202–204, 1944.

In this review of the Annual Report of the Research Department, Sugar Manufacturers' Association, 1942–43, the author includes some notes on the reactions to mosaic of some of the more important sugar-cane varieties which are being tested on Jamaican estates in a search for a range suitable to the divergent environmental conditions prevailing on the Island [*R.A.M.*, xx, p. 226]. B.3439 is highly resistant to mosaic and its juice is exceptionally sweet, but a defective root system impairs its ratooning capacity under unfavourable soil conditions. The chief drawback of the high-yielding B.34104 is susceptibility to a mild form of mosaic, which does not persist in older canes but may constitute a source of infection for other productive varieties grown in its vicinity. The susceptibility to mosaic of the popular B.H.10(12), which does not excel either in tonnage or juice quality, is likely to result in its replacement in the near future by other varieties.

Chona (B. L.). **Sugar-cane smut and its control.**—*Indian Fmg*, iv, 8, pp. 401–404, 2 pl., 1943.

In India, there are two main flushes when sugar-cane affected by smut (*Ustilago*

scitaminea) [*R.A.M.*, xxii, pp. 197, 225] produces smut whips in profusion, the first in May and June, and the second in October and November. Under Delhi and Karnal conditions, the hot weather flush seems to be the major one, while in Bihar most infections occur in October and November, as the crop is ripening. It appears that all cases of primary infection, i.e., when setts which are planted harbour internal infection or contract infection soon after planting, develop the smut whips in May or June, while most infections occurring late in the season result from secondary infection.

In Co. K. 26, Co. 508, and Saretha, smut infections were observed on young leaves, forming small, slightly raised galls with a corrugated surface, covered with a silvery-white membrane which soon flaked off, exposing masses of dark, powdery spores. Infection tests with spores from leaf galls gave rise to typical infection.

The spores germinate readily under moist conditions, forming a promycelium, which divides transversely into three or four cells, each bearing a sporidium. Under favourable nutrient conditions, the sporidia may bud off more sporidia in short chains. Sometimes, the promycelium grows out into a branched hypha which acts as the infection thread. The mycelium grows between the host cells and sends haustoria into them but quickly becomes so depressed that it cannot easily be traced in the host tissue, except in the whip.

When infection occurs early, the smutted clumps produce only thin, spindly canes or small, grassy shoots, but if it takes place later on, a few millable shoots may be produced. The disease appears to be increasing. Co. 213 and Co. 299 showed considerable infection in a few fields, Co. S. 5, Co. 538, Co. K. 25, Co. K. 26, Co. K. 28, and Co. K. 30 were appreciably infected at the Gorakhpur Farm, Co. 312 showed 12 to 50 per cent. infection at Fyzabad, and Co. 313 about 5 per cent. smut in three localities but in several others was severely affected. The thin indigenous reed canes are highly susceptible, while the thick Ponda (*Saccharum officinarum*) varieties have a low smut incidence. In resistance tests Co. 513, Co. 531, Co. K. 10, Co. K. 25, Co. 362, Co. 526, Co. 433, Co. 444, Co. 417, Co. 532, Co. K. 26, and 524 developed 20 to 40 per cent. smut, whereas Co. 313 showed only 10 to 15 per cent. infection.

Effective control results from systematic roguing and careful selection of seed material for three successive seasons. In a 12-acre block of cane where certain Co. 313 plots showed up to 50 per cent. smut, incidence fell to about 3 to 4 per cent. after the first season of roguing and seed selection. Roguing was continued at short intervals throughout the second season, and incidence was reduced to about one-fortieth of the original infection. In the third and present season, roguing is being continued, and incidence is negligible. In roguing, the smut whip should be cut off and placed in a closely woven bag, so that the spores are not dispersed. Entire clumps, if found to be affected, should be removed, not merely individual smutted canes. When setts from smutted canes of 16 varieties were dipped for 10 minutes in water at 55° to 60° C. and then planted, all the plants remained unaffected, though the untreated controls developed 87 per cent. infection. Further investigations into the hot-water treatment are in progress.

Cross (W. E.). **Variedades de Caña resistentes al 'carbón'.** [Cane varieties resistant to 'smut'.]—*Bol. Estac. exp. agríc. Tucumán* 45, 25 pp., 1944.

During the season of 1943–4, the C.P. 29/320, Kavangire, P.O.J. 213, and Tuc. 407, 472, 1376, and 1400 sugar-cane varieties sustained fairly severe damage from smut [*Ustilago scitaminea*: *R.A.M.*, xxiii, p. 189] and should be excluded from future plantings in Tucumán, Argentina, although reasonably high yields are admittedly obtainable, at any rate for a number of years, from the immensely vigorous and productive P.O.J. 213 and Tuc. 472 and 1376. The following, on the other hand, remained virtually immune from the disease: Co. 290, P.O.J. 2725,

2727, and '2961' (botanically identical with 2878), and Tuc. 379, 1111, 1149, 1190, 1296, 1406, 1422, 1590, 2605, 2611, 2613, 2622, 2634, 2645, 2651, 2657, 2680, 2683, 2701, 2704, and 2705. A fair degree of resistance was shown by Co. 270, 281, 284, and 289, C.P. 807, P.O.J. 1337, 1507, 2878, and Tuc. 630, 1139, 1199, 1220, 1231, 1238, and 1316. Descriptions are given of the distinguishing features of the immune and resistant varieties, of which Co. 290, 270, 281, and 284, P.O.J. 2725 and 2878, and Tuc. 379, 1111, 1406, 2622, 2645, 2680, 2683, 1199, and 1316 are already being grown on a commercial scale.

HANSFORD (C. G.). **Contributions towards the fungus flora of Uganda. V. Fungi Imperfecti.**—*Proc. Linn. Soc. Lond., 1942–3,* 1, pp. 34–67, 15 figs., 1943.

This further instalment of the author's annotated list of Uganda fungi [*R.A.M.*, xx, p. 597] includes the following items. The 39 hosts of *Macrophomina phaseoli*, ordinarily a weak parasite in the colony, are listed. *Coniothyrium fuckelii* causes rose canker. *Septoria dianthi* is present wherever carnations are grown, and *S. lycopersici* is widespread on tomatoes. *Diplodia natalensis* has been found on orange twigs.

Colletotrichum [*Glomerella*] *gossypii* occurs on cotton bolls, mostly in wet seasons. *C. lindemuthianum* is present on old bean leaves and pods. *Cylindrosporium tephrosiae* n.sp. forms lenticular, often confluent, white to pale buff, dark-bordered interveinal spots, 3 by 1 mm., on the upper side of *Tephrosia vogelii* leaves, those on the under surface being light brown with less prominent margins. The hyaline acervuli, emerging through the stomata, measure 20 to 40 μ in diameter and up to 10 μ in height, and the parallel, erect, filiform, tri- to quinqueseptate conidia, slightly tapering towards the apex, 55 to 110 by 3 μ. Severe infection results in defoliation.

Hyalodendron album [ibid., xv, p. 70] on *Vigna* and *Phaseolus* exactly resembles *Cladosporium herbarum* except for the persistent absence of colour in all parts. Tomatoes are subject to infection by *C. fulvum* under humid conditions. *Piricularia oryzae*, the agent of rice 'blast', is a limiting factor in the production of the crop and also causes serious damage to *Eleusine coracana*; on *Digitaria* it is usually restricted to the foliage.

Heterosporium echinulatum [*Didymellina dianthi*] has been observed on carnation leaves, and *H. lagunense* on dead *Canavalia ensiformis* stems and pods. *Phormium tenax* leaves in the Entebbe Botanic Gardens bore the dark brown to black patches characteristic of *Dendryphiella interseminata*. *Curvularia lunata* is widely distributed on sugar-cane and other Gramineae. *Helminthosporium capense* is a parasite of *Meliola*, *Irene*, *Irenina*, and *Irenopsis* spp. It was first described by Thümen as a parasite of *Cunonia* and *Osyris* leaves from South Africa (*Flora*, lix, p. 570, 1876), but an inspection of the original collections showed that in both cases the fungus was growing directly on Meliolineae on these hosts. A list of synonyms is given, including *Helminthosporium coffeae*. *H. helianthi* n.sp. forms blackish-brown, zonate spots, with ashy centres, up to 10 mm. in diameter, on leaves of sunflowers. The conidia are elongated, ellipsoid, straight, rounded at the base, with the hilum entirely within the curve of the basal cell, 2 to 8 septate, 30 to 90 by 11 to 16 μ. The conidiophores are unbranched, 2- to 5-septate, 70 to 120 by 8 to 10 μ. *H. musae-sapientum* n.sp. forms blackish-brown, oval spots, 10 to 15 mm. in length, on banana leaves. The erect conidiophores are 70 to 250 by 9 to 12 μ and the conidia straight or curved, ellipsoid or subcylindrical, 4- to 12-septate, 55 to 135 by 16 to 27 μ. *Sporodesmium bakeri* Syd. was detected on the dead leaves of a Liliaceous plant in the Entebbe Botanic Gardens. *Sorghum verticilliflorum* leaves were infected by *Clasterosporium maydicum*. *Stigmella sacchari* Speg. occurs on sugar-cane and germinating rice seeds, and has been cultured from a parasitized colony of *Meliola*. *Alternaria gossypina* and *A. macrospora* [*R.A.M.*, xx, pp. 461, 573]

have been observed on cotton leaves, and the latter was also isolated from stained lint; *A. longipes* produces large spots on tobacco foliage, and *A. sesamicola* infects the stems of sesame (*Sesamum indicum*) [ibid., xi, p. 350]. *Cercospora anethi* attacks *Anethum graveolens*, *C. atrocincta* is ubiquitous on *Zinnia elegans*, groundnuts are infected by *C. arachidicola* and *C. personata*, *Boehmeria nivea* by *C. boehmeriae*, *Cinchona* by *C. cinchonae*, coffee by *C. coffeicola*, potato by *C. concors* [ibid., xx, pp. 234, 447], cowpea by *C. cruenta*, *Crotalaria juncea* by *C. demetrioniana*, cotton by *C.* [*Mycosphaerella*] *gossypina*, sugar-cane by *C. longipes*, mango by *C. mangiferae*, banana by *C. musae* [*M. musicola*], buckwheat by *C. polygonacea*, *Ricinus communis* by *C. ricinella*, roses by *C. rosicola*, and sorghum by *C. sorghi*. *C. papayae* n.sp., the agent of blackish-brown, irregular, confluent spots, 5 to 10 mm. in diameter, on papaw leaves, is characterized by fasciculate, olivaceous to black, erect, bi- to quadriseptate, simple conidiophores, 80 to 130 by 4 to 5 μ, occurring in bundles of up to 30 and showing abrupt geniculations at the conidial attachments, the scars persisting as dark olive, raised, thickened areas of the wall, and hyaline, filiform, 8- to 17-septate conidia, tapering towards the apex and rounded at the base.

Dendrochium gigasporum Bres. & Sacc. was isolated from dying *Cajanus indicus* stems. *Camptomeris tephrosiae* n.sp., the agent of a lenticular, yellow to brown leaf spot of *T. candida*, resulting in defoliation, is characterized by straight, olive-brown, bi- to triseptate, simple conidiophores, 30 by 10 μ, tapering towards the base, and clavate to cylindrical, blackish-brown, tri- to quinqueseptate conidia, 50 to 95 by 16 to 22 μ, truncated at the base and rounded at the apex.

WOLLENWEBER (H. W.). **Fusarium-Monographie. II. Fungi parasitici et saprophytici.** [*Fusarium* monograph. II. Parasitic and saprophytic fungi.]—*Zbl. Bakt.*, Abt. 2, cvi, 8–10, pp. 171–202, 27 figs., 1943.

This further contribution to the author's monograph of the genus *Fusarium*, prepared on similar lines to the foregoing [*R.A.M.*, x, p. 626], comprises 26 species, 14 varieties, and four forms in the six groups *Macroconia*, *Submicrocera*, *Pseudomicrocera*, *Sporotrichiella*, *Roseum*, and *Martiella*. The perfect stages of four of these groups are known, viz., *Nectria* of *Macroconia*, *Calonectria* of *Submicrocera* and *Pseudomicrocera*, and *Hypomyces* of *Martiella*, while a genetic connexion is surmised to exist between *Roseum* and *Gibberella*. Fourteen related and other Hypocreaceae are also included in the list.

F. avenaceum, with over 70 synonyms and nearly 200 hosts, is one of the most ubiquitous representatives of the genus, while another cosmopolitan is *F. solani*.

Of special interest are the members of the *Macroconia* and *Pseudomicrocera* groups parasitizing scale insects and other pests in citrus groves and the like. The type species of *Pseudomicrocera* is *F. coccidicola* P. Henn., the conidial state of *C. diploa* (Berk. & Curt.) Wollenw. [ibid., xviii, p. 504].

N. ecoccophila Wollenw. n.n. is the new name applied to *N. coccophila* (Tul.) Wollenw. & Reinking [ibid., xiv, p. 708] (syn. *Sphaerostilbe coccophila* Tul., *Corallomyces aurantiicola* (Berk. & Br.) Höhn.). It is proposed to exclude the following: *F. juruanum* P. Henn. (1904), *F. lateritium* Nees var. *minus* Wollenw., and *F. cerasi* Roll. & Ferry. as being identical, respectively, with *F. coccidicola* P. Henn. (1903), *F. lateritium* Nees, and *Micula mougeotii* Duby.

SLIPP (A. W.) & SNELL (W. H.). **Taxonomic-ecologic studies of the Boletaceae in northern Idaho and adjacent Washington.**—*Lloydia*, vii, 1, pp. 1–66, 8 pl., 1944.

This annotated and illustrated list of 23 species of Boletaceae from northern Idaho and adjacent Washington is introduced by a discussion of the zones in which they occur; of their relation to forest associations and to mycorrhiza, it becoming

increasingly apparent that these species are important and regular constituents of the latter; and of the effect of association and environment upon intraspecific variations. The list is provided with one key based on gross characters and another on generic distinctions, and a synopsis of the genera of the Boletaceae as proposed by Snell (*Mycologia*, xxxiii, pp. 415–423, 1941; xxxiv, pp. 403–411, 1942) is included.

MARTIN (G. W.). **The Tremellales of the north central United States and adjacent Canada.**—*Univ. Ia Stud. nat. Hist.*, xviii, 3, 88 pp., 5 pl., 1944.

This is a critically annotated list, supplemented by keys to the genera and species, of the Tremellales of the north-central United States (comprising Ohio, western Kentucky, Michigan, Indiana, Wisconsin, Illinois, Minnesota, Iowa, Missouri, and the eastern portions of North and South Dakota, Nebraska, and Kansas) and the southern regions of the Canadian Provinces of Ontario and Manitoba. The taxonomy and morphology of the group are discussed in a prefatory note, and three new combinations are proposed.

SINGER (R.). **A monographic study of the genera 'Crinipellis' and 'Chaetocalathus'.**—*Lilloa Rev. Bot. Tucumán*, viii, 2, pp. 441–534, 6 figs., 1942. [Spanish summary. Received June, 1944.]

The author's exhaustive, critical survey of the genus *Crinipellis*, described as one of the most important genera of Agarics for phytopathologists, and his new genus *Chaetocalathus* has involved a revision of their taxonomic relations and the establishment of a number of new species and combinations. Among the parasitic members of the former genus are *Crinipellis perniciosa* comb.n. (*Marasmius perniciosus* Stahel), the agent of witches' broom of cacao; *C. stipitaria*, widely distributed in Europe, North Africa, and the United States on living roots and green parts of Gramineae, including rye and other cereals; *C. pseudostipitaria* n.sp., and allied tropical forms collected, for instance, on *Panicum maximum* in Guadeloupe and *Andropogon* in the Niger valley, West Africa; and *C. siparunae*, which annually attacks living *Siparuna* trees from Brazil in a greenhouse of the Leningrad Botanical Garden, branches and twigs up to 10 ft. above soil-level being affected.

Stahel's diagnosis of *M. perniciosus* (*Bull. Dep. Landb. Suriname* 33, 1915) is recapitulated and supplemented by personal observations on various macro- and microscopical characters of specimens from Dutch and British Guiana.

The monograph is provided with keys for the determination of the species of *Crinipellis* and *Chaetocalathus*, lists of ambiguous species and of those to be excluded from the former genus, an index of (*a*) hosts, and (*b*) sections, subsections, species, subspecies, varieties, and forms of both genera, and a bibliography of 25 titles.

VAN DER PLANK (J. E.) & ANDERSSEN (E. E.). **Kromnek disease of Tobacco.**—*Fmg S. Afr.*, xix, 219, pp. 391–394, 2 figs., 1944.

In many parts of the Transvaal, the most damaging disease of tobacco is kromnek [tomato spotted wilt virus: *R.A.M.*, xix, p. 620], which appears every year in the Brits district and elsewhere. It is particularly troublesome among young plants, soon after transplanting, and is generally more prevalent early in the season than in crops planted later in summer.

Control is facilitated by the fact that the insect vectors [*Frankliniella schultzei* and ? *Thrips tabaci*: loc. cit.] remain more or less immobile on the tobacco plants. Infection appears to come invariably from some plant other than tobacco. The number of infective insects arriving in a field is not unlimited, and a good stand of plants can be saved by transplanting more than would be needed if all remained healthy. The excess plants are spares, which act as host to the infective insects which come into the field, and so safeguard the rest. In tests at Brits doubling the number of plants set out in a field has always resulted in a good stand of healthy

plants. When severe outbreaks occurred, double numbers saved the crop, while fields planted out in the normal way had to be ploughed under.

After transplanting thickly, the plants can be left for four to eight weeks and the excess plants then pulled up. Even when plants are large, close planting is of great value against the disease, and the best method of control is to maintain as many plants as possible per unit area at all stages of growth. Doubling the stand by planting in pairs with the same distance between each two pairs as normally exists between two single plants has the advantage that in thinning out one of the pair can be left and an even spacing maintained. Infection of both plants in a pair is very uncommon. In two seasons' tests at Brits with several varieties, the percentages of plants lost ranged from 2 to 26·1 (average 11·2) for the ordinary method of planting and from 0 to 2·9 (average 1·15) for planting in pairs.

Rawlins (T. E.). **Stream double refraction studies on the orientation of Tobacco mosaic virus particles.**—*Science*, N.S., xcix, 2579, pp. 447–449, 1944.

A recent modification of technique for the study of tobacco mosaic virus particles led to a slight revision of some of the author's previous conclusions [*R.A.M.*, xii, p. 525]. The newly obtained evidence indicates that the flowing rod-shaped particles of this virus do not produce uniform bi-refringence throughout the width of the stream but show less in a narrow central portion of the stream than in the adjacent regions on each side of it. In the regions with the strongest bi-refringence the particles are not exactly parallel to the direction of flow but have their forward ends tilted towards the middle of the stream at an angle of approximately 15° to the direction of flow. This and further evidence (to be published at a later date) lead the author to conclude tentatively that there is a tri-dimensional orientation of tobacco mosaic virus particles.

Smith (T. E.). **Status of Tobacco blackshank in North Carolina.**—*Plant Dis. Reptr*, xxviii, 4–5, p. 159, 1944. [Mimeographed.]

New strains of tobacco, Oxford 1, 2, 3, and 4, resistant to black shank (*Phytophthora parasitica* var. *nicotianae*) [*R.A.M.*, xxii, p. 411; xxiii, p. 318], were released for general use in North Carolina in 1943 with excellent results in spite of generally unfavourable seasonal conditions. Oxford 1 produced 800 lb. of tobacco per acre on one badly contaminated farm in Forsyth County where one of the regular varieties had yielded slightly less than 100 lb. the previous year. Although resistance to black shank was generally adequate, in some cases a loss of up to 20 per cent. of the plants occurred in beds or fields where tobacco had been badly diseased in 1942. The period of maximum loss in such fields was shortly after plants were set out, when they are apparently most susceptible, indicating the need for continued sanitary practices which would lessen the likelihood of infection during the early stages of growth. The best results both in quality of the crop and disease control were obtained on soil rested from tobacco for two or three years. The author is inclined to accept the view expressed by Vaughan (*Plant Dis. Reptr*, xxvii, pp. 643–645, 1943) that wind-borne inoculum may be responsible for the spread of black shank. In four new outbreaks in North Carolina the incidence of the disease could not be explained satisfactorily by the movement of infected plant material or contaminated soil. In 1941, leaf and stem lesions due to black shank infection were found abundantly in a few fields where soil-borne inoculum was present, but often occurred near the top of the plant, so that infection from spattered surface soil seemed unlikely. It is concluded that under favourable conditions black shank may spread by air for short distances. Granville wilt (*Bacterium* [*Xanthomonas*] *solanacearum*) is stated to be widespread in a part of the area attacked by black shank. The occurrence of both diseases in the same area presents

a serious problem, as none of the commercially usable strains combines resistance to both.

SMITH (T. E.). **Control of bacterial wilt (Bacterium solanacearum) of Tobacco as influenced by crop rotation and chemical treatment of the soil.**—*Circ. U.S. Dep. Agric.* 692, 16 pp., 4 figs., 1 graph, 1944.

The results of investigations on the control of tobacco bacterial wilt (*Bacterium* [*Xanthomonas*] *solanacearum*), which have been in progress since 1935 at the North Carolina Agricultural Experiment Station [*R.A.M.*, xix, p. 123], showed that crop rotation (preferably triennial) afforded a measure of success, maize, soy-beans (formerly believed to be susceptible to the pathogen), and red top (*Agrostis alba*) being the most suitable forerunners of tobacco, especially the first-named. Under the exceptionally favourable conditions for the disease prevailing in 1939, these three crops were more effective than crabgrass (*Digitaria sanguinalis*), sweet potato, or native weeds. Tests of wilt-resistant tobacco strains in combination with crop rotation showed that an increase in the control of infection followed the cultivation of a slightly resistant line, e.g., Davis Special, on land rotated to maize for one year, but little or no benefit was obtained by the use of moderately resistant strains (T.I. 79 A and Zanthi) or even highly resistant ones (T.I. 448 A and 79 X) as an adjunct to rotation.

Soil treatment with urea at a rate supplying 420 lb. nitrogen per acre, in conjunction with a one-year maize rotation, resulted in the production of a normal crop of high-grade tobacco. The maximum benefit, especially from lower doses (105 or 210 lb. nitrogen per acre) of the compound, was secured by spring applications. In a total of nine replicates at five locations, commercial-grade urea (containing 42 per cent. nitrogen) was applied at dosages of 250, 500, and 1,000 lb. per acre in October, 1941 and March, 1942. Maize was grown in the latter year and tobacco in 1943. The maize grew vigorously on all the sites, the average yields for the three rates of urea (combined with 500 lb. 0–10–10 fertilizer per acre) being 27·1, 46·8, and 55·8 bush. per acre, respectively. The mean wilt percentages in the tobacco crop treated at the three rates were 63, 36·4, and 13, respectively; only the heaviest dosage was regarded as commercially adequate. The cost of 1,000 lb. urea required to treat one acre was $40, based on pre-war prices, which is considered economically sound in view of the increased maize yields and prevention of loss from wilt, which often exceeds $100 per acre. Chloropicrin also gave good control of wilt, but is too expensive and the technique of application too complicated for large-scale use.

POLLARD (L. H.), PETERSON (H. B.), BLOOD (H. L.), & PEAY (W. E.). **Tomato production in Utah.**—*Circ. Utah agric. Exp. Sta.* 120, 31 pp., 16 figs., 1944.

In the section of this circular dealing with diseases of tomatoes in Utah, H. L. Blood gives descriptions with recommendations for the control of *Verticillium* [*V. albo-atrum*: *R.A.M.*, xxi, p. 542] and *Fusarium* [*F. bulbigenum* var. *lycopersici*: ibid., xxiii, p. 121] wilts, damping-off, fruit rots, bacterial canker [*Corynebacterium michiganense*: ibid., xxi, p. 353], curly top [ibid., xxii, p. 44], mosaic, and double virus streak, caused by a combination of the tomato mosaic and the so-called potato latent [potato X] viruses. Spotted wilt is stated not to be serious enough in Utah to warrant control measures against the thrips, sufficient protection being afforded by locating seed beds and fields away from home gardens or commercial plantings of perennial ornamentals. To control blossom-end rot, it is recommended to use a fertile soil and to maintain uniform moisture throughout the summer. Sunscald, a physiological disorder resulting from the exposure of green or partially ripened fruit to direct sunlight, is stated to be rather prevalent in Utah, being favoured by *Verticillium* wilt infection, improper application of irrigation water, and poor

cultural practices. In the mild form, it causes a yellow or whitish patch on the side of the fruit facing the sun; when more severe, it may form a large, flattened, greyish-white spot with a dry, papery surface. For the control of this disorder it is essential to control *Verticillium* wilt, to avoid excessive irrigation, and to refrain from all practices involving the cutting-away of much of the foliage and thus exposing the fruit to direct sun rays. A blossom drop frequently observed in Utah follows the failure of tomato plants to set a normal crop of fruit, resulting in reductions in yield. The condition is influenced by a number of environmental factors, such as low soil moisture accompanied by hot, drying winds, or spells of sudden cool weather and beating rains; excessive application of nitrogenous fertilizers may also be responsible for it. It is recommended to keep up the soil moisture during periods of hot dry weather, avoiding excessive application of water or of fertilizers with high nitrogen content.

ARK (P. A.). **Studies on bacterial canker of Tomato.**—*Phytopathology*, xxxiv, 4, pp. 394–400, 1944.

White, pink, and rough variants of tomato canker (*Phytomonas michiganensis*) [*Corynebacterium michiganense*] were studied at the University of California, Berkeley, in comparison with the normal strain in respect of their physiological and pathogenic characters [*R.A.M.*, xiii, p. 547]. They were found to differ slightly from the ordinary yellow strain in their reactions to sugars on culture media and to cause less damage to their host, the pink mutant in particular being relatively innocuous.

Inoculation experiments with *C. michiganense* gave positive results on *Cyphomandra betacea*, which developed a black discoloration of the fibrovascular system; *Solanum nigrum* var. *guineense* responded similarly, while *Nicotiana glutinosa* showed foliar chlorosis and wilting, occasionally accompanied by the formation of minute cankers. *Lycopersicon pimpinellifolium* proved to be only slightly susceptible, while tobacco remained immune. Higher percentages of infection were obtained by cutting off the tips of tomato seedlings with a contaminated knife (up to 100 per cent.) than by the needle-prick method of inoculation (4 per cent.). The knife cuts remained susceptible to invasion for 72 hours. Infection may also be conveyed from diseased to healthy plants by handling in the course of transplanting operations. Uninjured plants did not develop the disease when sprayed with a heavy suspension of the pathogen and incubated in a moist chamber. Transmission tests with five species of insects gave negative results.

Corynebacterium michiganense was killed by aqueous solutions of brilliant green and malachite green (1 in 1,000) in five minutes, comparable effects being produced by rosaniline hydrochloride at the same strength in one hour. The addition of 5 (but not of 30) per cent. alcohol to the dyes retarded their bactericidal action, the periods then required by malachite green, brilliant green, and rosaniline hydrochloride to destroy the organism being 10 to 15 minutes and 24 hours, respectively. The germinability of tomato seed was not impaired by 24 hours' immersion in aqueous solutions of the dyes or by upwards of one hour in the same with the addition of alcohol. The maximum percentage of infection in plants grown from treated seed was 4·3 per cent. (1 in 1,000 malachite green in water only) compared with 26 in the untreated controls.

Dry heat did not injure Santa Clara Canner tomato seeds exposed to sufficiently high temperatures to kill *C. michiganense*. Dry (two-year-old) seeds can withstand air temperatures up to 85° C. for 15 hours, but this treatment caused a reduction of germination down to 40 per cent.

BUCHHOLTZ (W. F.). **Tomato leaf spot diseases in South Dakota.**—*Circ. S. Dak. agric. Ext. Serv.* 408, 7 pp., 2 figs. (1 col.), 1 map, 1944.

This popular booklet on tomato leaf spot diseases in South Dakota gives the

following recommendations for their control. *Septoria* [*lycopersici*: *R.A.M.*, xxiii, p. 82] can be controlled by measures directed against the overwintering source of infection, such as burning or thorough ploughing-under of all plant remains, and crop rotation; by measures ensuring rapid drying of the foliage after rain, such as the choice of open, airy locations and the trimming and staking of plants; by avoiding walking or working among the plants when the leaves are wet; and by spraying with Bordeaux mixture at 10-day intervals beginning soon after the first fruits are set. All the above-mentioned measures are applicable for the control of *Alternaria* [*solani*: ibid., xxiii, p. 318] also, and in addition, seed treatment with mercury or copper dusts and growing seedlings in soil not previously cropped to tomatoes are recommended.

MILLER (P. A.) & ROEWEKAMP (F. W.). **Environmental factors in relation to tree decline.**—*Trees*, vi, 1, pp. 9–11, 4 figs., 1 graph, 1 map, 1943.

During 1941, sudden decline and death of many large roadside trees occurred in the San Fernando Valley, California. Of the 217 trees found severely affected or killed, 198 were deodar cedars (*Cedrus deodara*), 15 magnolias (*Magnolia grandiflora*), two Monterey pines (*Pinus radiata*), and two acacias (*Acacia decurrens* and *A. melanoxylon*), while trees of *Casuarina stricta* and *Sterculia diversifolia*, though interplanted with diseased trees of other species, showed no apparent injury, and *Phoenix canariensis*, Washington [*Washingtonia filifera*], and *Trachycarpus fortunei* palms exhibited only very slight symptoms. The features of decline or collapse are stated to vary with the extent to which the functional root system of a tree has been impaired or destroyed, but they may not appear until some time after this root injury has occurred. Examination of the root systems of collapsed trees showed that all the main and lateral roots below the 3 or 4 ft. level were rotten and decomposed. Environmental factors contributing to the occurrence of decline in the area are heavy rainfall, heavy soils, poor drainage, waterlogging and consequent lack of aeration of the soil in the root zone, and the presence of toxic materials in the soil. An analysis of water samples from holes revealed a specific electrical conductance and boron and nitrite concentrations far in excess of those considered as injurious to most plants.

MURRILL (W. A.). **Fungous diseases of Florida forest trees.**—*Plant Dis. Reptr*, xxviii, 3, pp. 103–112, 1944. [Mimeographed.]

This list of fungous diseases of wild native trees in Florida is arranged under four headings: leaf diseases, trunk and branch diseases, root diseases, and rust diseases. Each group is introduced by a short general note, and the fungi listed alphabetically with the common name of the host, an index of scientific names of the hosts being appended.

ARK (P. A.). **Pollen as a source of Walnut bacterial blight infection.**—*Phytopathology*, xxxiv, 3, pp. 329–334, 3 figs., 1944.

The few cankers in evidence in a recent epidemic of walnut bacterial blight (*Phytomonas* [*Xanthomonas*] *juglandis*) in California led to an inspection of dormant catkin and leaf buds and the pollen of diseased catkins, all of which were found to be contaminated [*R.A.M.*, i, p. 397]. In a series of tests in 1942–3, 16 per cent. of the catkins collected on 20th August, 1942, yielded virulent living cultures of the bacterium, the corresponding figures for 15th September, 16th October, 12th November, 23rd December, 18th January, and 20th February, being 20, 15, 30, 26, 18, and 27, respectively. Of the blighted leaf buds on the same trees, 10 to 26 per cent. contained living organisms in cultures made at monthly intervals from August to February. In the spring of 1943, numerous colonies of *X. juglandis* developed on nutrient agar plates on which the pollen from diseased catkins was

shaken in the field, and the pathogenicity of the cultures was established by inoculations on immature nuts in May and June. Other experiments demonstrated the possibility of blight dissemination by a mixture of diseased and healthy pollen, such as would occur in nature in partially diseased catkins. *X. juglandis* makes profuse growth on agar jelly with no other nutrient than walnut pollen, from which it was recovered after four months' storage.

MILLER (P. W.). **Further investigations on the war-time control of Walnut blight and Filbert blight.**—*Proc. Ore. St. hort. Soc.*, xxxv (*1943*), pp. 103–106, 1944.

In further work on the control of walnut blight (*Xanthomonas juglandis*) [*R.A.M.*, xxii, p. 411] in Oregon, attempts to find a satisfactory substitute for Bordeaux mixture were continued. Under the conditions prevailing in 1943, thiosan and fermate were ineffective. Additional evidence was obtained that Bordeaux mixture (4–2–100) gives almost as good control in an average season as stronger concentrations, if the applications are made thoroughly. In tests near Scholls, two applications at 4–2–100 reduced infection from 33·4 to 2·3 per cent., while two applications at a concentration of 6–2–100 reduced it to 1·9 per cent. Similar results followed a reduction in the concentration of yellow cuprous oxide from 1½ lb. in 100 gals. water to 1 lb., two applications at the lower strength reducing infection from 33·4 to 6·5 per cent., and at the higher to 5·5 per cent. In tests with fixed copper compounds containing comparatively small amounts of metallic copper, two applications of zinc-copper ammonium silicate (4–100), copper oxalate (2–100), and tribasic copper sulphate (2–100) reduced infection from 43·9 per cent. to 4·3, 5·4, and 6·5 per cent., respectively. Two applications of Bordeaux mixture (4–2–100) reduced infection to 5·9 per cent. In dusting trials, two applications of a 25 per cent. copper-lime dust at late pre-bloom and early post-bloom reduced infection from 57·4 to 16·7 per cent., two applications of Bordeaux mixture at approximately the same times reducing infection in a neighbouring orchard to 8·6 per cent. The evidence indicated that three to five dustings are necessary to ensure satisfactory control. This entails the use of more metallic copper than does spraying, but dusting may be resorted to as an emergency measure.

Further tests confirmed the results obtained in earlier work on the control of filbert [*Corylus avellana*] blight (*Phytomonas corylina*) [ibid., xxi, p. 310], again showing that prompt spraying with Bordeaux mixture materially reduces bud and twig blight. In one test, one application of Bordeaux mixture reduced bud and twig blight incidence from 3·6 to 0·3 per cent. Current studies indicate that Bordeaux mixture (6–2–100) is as effective as 8–4–100. To secure adequate control of twig blight a film of spray must uniformly coat the buds in the axils of the leaves. A good spreader and sticking agent must be used, a special effort made to spray thoroughly, and before the first rain. If rainfall is abnormally heavy in autumn, winter, and early spring, supplementary applications may be required in late autumn when about three-quarters of the leaves have fallen, and again in early spring, just after the leaf buds open.

Service and regulatory announcements, October–December, 1943. Plant-quarantine import restrictions, Republic of Mexico.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, p. 42, 1944.

Exterior quarantine No. 7 prohibits the entry into, or passage through, the Republic of Mexico of all species of banana plants or parts thereof, including fruits, from any foreign country, on account of the risk of introduction of Panama disease (*Fusarium* [*oxysporum* var.] *cubense*) or leaf spot (*Cercospora musae*) [*Mycosphaerella musicola*]. Exempt from this regulation (under certain prescribed conditions and subject to permission by the Director-General of Agriculture) are consignments of bananas from Guatemala.

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Rhoads (A. S.). **Further notes on Clitocybe root rot of woody plants in Florida.**—*Plant Dis. Reptr*, xxvii, 24, pp. 694–696, 1943. [Mimeographed.]

Further records of root rot due to *Clitocybe tabescens* [*R.A.M.*, xxi, p. 497] in Florida include, among others, *Casuarina cunninghamiana*, planted in or about citrus groves in an effort to secure cold protection, loquat, laurel oak (*Quercus laurifolia*), *Jacaranda ovalifolia*, and Brazilian pepper (*Schinus terebinthifolius*).

Campi (M[aria] D.). **El marchitamiento de la Acacia de Constantinopla ('Albizzia julibrissin') y su relación con la presencia de 'Fusarium oxysporum' Schl. f. 'perniciosum' (Hepting) Snyder.** [The wilt of the Constantinople Acacia (*Albizzia julibrissin*) and its relation to the presence of *Fusarium oxysporum* Schl. f. *perniciosum* (Hepting) Snyder.]—*Lilloa Rev. Bot. Tucumán*, ix, pp. 457–460, 5 figs., 1943.

Since 1938, a wilt of *Albizzia julibrissin*, characterized by symptoms identical with those described from the United States as due to *Fusarium perniciosum* [*R.A.M.*, xxiii, p. 366], or according to Snyder's system of classification, *F. oxysporum* forma *perniciosum* [ibid., xxi, p. 223], has been present in the Mercedes [Buenos Aires] district of Argentina. Positive results were obtained in inoculation experiments only through the soil, in which infection evidently originates.

Large (J. R.). **Alcoholic flux or white slime flux of Tung trees.**—*Plant Dis. Reptr*, xxviii, 1, pp. 35–36, 1944. [Mimeographed.]

The disease of tung trees (*Aleurites*) similar to alcoholic flux or white slime flux of oak (E. F. Guba, *Proc. nat. Shade Tree Conf.*, x, pp. 56–60, 1934), which was known to have occurred in 1938 in the vicinity of Covington, Louisiana, where it was studied and described in 1939 and 1940 by Hines (*Proc. Amer. Tung Oil Ass.*, vi, pp. 12–14, 1940), but was not observed anywhere in the United States during 1941 and 1942, was found in 1943, by E. Angelo, near Folsom, Louisiana. The symptoms of the disease are as follows: a foamy exudate flows from cracks in the bark near the crotch in late summer, usually during early September, accompanied by a characteristic odour of fermentation, attractive to insects; later, an icicle-like mass of gelatinous flux extends down the trunk of the tree from the crotch canker; eventually the trunk is girdled and the tree dies. An as yet unidentified bacterium and an organism considered to be an Actinomycete were isolated by the author from the 1943 canker, and further studies are in progress.

Priehäusser (G.). **Über Fichtenwurzelfäule, Kronenform und Standort. Beitrag zur Kenntnis der Fichtenrotfäule.** [On Spruce root rot, crown shape, and habitat. A contribution to the knowledge of Spruce red rot.]—*Forstw. Zbl.*, *1943*, 6, pp. 259–273, 3 figs., 1943.

Full particulars are given of a comprehensive study on the etiology of a root rot of the spruces in a 60- to 70-year-old stand in the Bavarian Forest near Sträubing.

The primary cause of the trouble was found to be a disturbance of the soil water economy, which does not, however, interfere with the functions of the root system until thinning operations admit direct sunlight, and inadequate protection on the outskirts of the wood gives access to drying winds. The desiccated roots become susceptible to infection by *Trametes radiciperda* [*Fomes annosus*: *R.A.M.*, xvii, p. 86; xxii, p. 120], which lessens the value of the wood and induces anomalies of growth, the neiloid crown with its concave sides, for instance, formed by a diseased tree tending to collapse under pressure of snow. Root-rotted spruces are also liable to be overturned in a storm.

The following possibilities of control are suggested: (*a*) prevention of drying-out of the soil by the maintenance of dense crowns and a compact fringe of shade trees, preferably such as produce an abundance of stool shoots; (*b*) encouragement of the timely development of a deep root system; and (*c*) the replacement of the spruce in localities of the type under observation by fir [*Abies*], pine, larch, or hardwoods.

HUBERMAN (M. A.). **Sunscald of Eastern White Pine, Pinus strobus L.**—*Ecology*, xxiv, 4, pp. 456–471, 3 figs., 1 diag., 3 graphs, 1943.

'Sunscald' is a serious injury to the cambium on the south-west side of eastern white pine (*Pinus strobus*) trunks, the dead strips of bark on which partially peel off and expose the killed sap-wood. The disorder affects dark-coloured, smooth-barked trees, averaging 31 to 51 years of age, on the north and east edges of openings made in forest stands throughout the white pine regions of New England and has also been observed in plantations outside this area. The wounds thus inflicted, besides lowering the grade of logs cut from the scalded part of the trunk, or even rendering them unmarketable, afford ingress to pests and diseases liable to cause further deterioration and endanger the rest of the stand. The scalded strips are 6 to 29 ft. long and 3·3 to 7·7 in. wide (maximum), commencing from 0 to 8 ft. above the ground-line and extending 3·5 to 23 ft. up the trunk. Evidence is adduced to show that the injury occurs between 1st October and 1st April, probably as a result of rapid freezing. It may be avoided by making the smallest possible openings consistent with sound silviculture in harvest and improvement cuttings, leaving 'screen' trees uncut on the southern and western borders of wood lots. Extensive clear-cutting should not be practised, and young trees should be pruned in two or more steps.

SCHEFFER (T. C.), LACHMUND (H. G.), & HOPP (H.). **Relation between hot-water extractives and decay resistance of Black Locust wood.**—*J. agric. Res.*, lxviii, 11, pp. 415–426, 1 fig., 1 graph, 1944.

The results of tests on the durability of black locust (*Robinia pseud-acacia*) [*R.A.M.*, xviii, p. 284], with *Fomes rimosus* as the test fungus, indicate that the amount of hot-water extractives in the wood accounts to a large degree for the decay resistance (expressed in terms of weight loss) of the heartwood at different radial positions in the cross section of individual trees, but only in small measure for the differences in decay resistance among different trees or selections of black locust, suggesting that the toxic composition of the extractive is comparatively uniform within individuals but not among different trees. A similar relation was generally found between decay resistance and the toxicity of the hot-water extractives as measured by the growth rate of *F. rimosus* on malt agar containing the respective hot-water extractives in amounts proportional to those present in the wood. Although theoretically this might be expected to be a better test, the toxicity of the extractives did not index decay resistance as accurately as did total extractive content, probably partly because the error in determining extractive content by measuring the growth rate of the fungus was about three times as great as that in determining it by direct weighing. It is also thought possible that on

substrata as diverse as malt agar and wood, the behaviour of the toxicants may be entirely different. It would thus appear that the test involving measuring extractive content and its toxicity in terms of growth rate of the fungus in artificial culture, at least in the manner adopted in the present study, is inadequate for a precise evaluation of the decay resistance of different trees or selections of black locust. It is believed, however, that a modified procedure might prove more profitable.

It was also found in the course of the study that the amount of yellow colour in the wood, after conversion into sawdust, was roughly proportional to the total extractive content, thus bearing out the widespread belief in the greater durability of yellow heartwood. However, the relation was not consistent enough to serve as a basis of estimation.

Banerjee (S. N.) & Bakshi (B. K.). **On the production of true pilei of 'Polyporus brumalis' (Pers.) Fr. in artificial culture.**—*Curr. Sci.*, xiii, 4, pp. 102–103, 3 figs., 1944.

Experimental evidence is adduced to show that aeration is the determining factor in the production of true pilei in artificial culture by *Polyporus brumalis* [*R.A.M.*, xvi, p. 358]. The fungus, collected from a dead log at Calcutta, made abundant growth in closed tubes on Badcock's new medium [ibid., xxi, p. 176], but formed normal pilei only when the stoppers were removed to permit the access of oxygen, which probably neutralized the toxic effect on fructification of the accumulation of carbon dioxide due to vigorous mycelial respiration in the sealed containers. The experiment yielded no conclusive proof of any connexion between light, temperature, or humidity and sporophore formation.

Hepting (G. H.). **Preventing decay in wood aircraft.**—*Aero Dig.*, xliv, 4, pp. 126, 128, 142, 213, 4 figs., 1944.

Trouble having been experienced through the moulding of glue and consequent fungal decay of aeroplane wood [*R.A.M.*, xxiii, p. 201] in United States Army training machines, the writer gives directions for the recognition of such damage and its prevention by means of appropriate technical devices. Rotting may cause material loss in toughness or shock resistance before there is any noticeable softening or discoloration of the wood. Where casein glue without a preservative has been used the joints, if frequently exposed to water, invariably come apart before appreciable disorganization occurs. When there is no separation of the joints, owing to the use of a more waterproof glue, the best evidence of decay is the presence of free water or mud, extensive water-staining (mahogany generally stains black) [cf. ibid., xxiii, p. 202], or a sour or fermenting odour in the structure.

The woods (except mahogany) commonly used in aircraft construction, e.g., spruce, yellow poplar [*Liriodendron tulipifera*], western hemlock [*Tsuga heterophylla*], noble fir [*Abies nobilis*], sweet gum [*Liquidambar styraciflua*], maple [*Acer* spp.], and ash, are not classed as decay-resistant, and any major swing towards their replacement by more durable species, or to thorough impregnation, would not be practicable at the present juncture. Protection against excess moisture should therefore be based on the provision of proper drainage and precautions to minimize the intake of water from rain, washing, and landing gear splash, and to reduce leakage at the necessary openings.

Tyler (L. J.). **Vegetable storage diseases in New York.**—*Plant Dis. Reptr*, xxviii, 4–5, pp. 143–155, 1944. [Mimeographed.]

This is a summary of observations, partly accompanied by tabulated data, on storage rots [*R.A.M.*, xxi, p. 316] of carrots, celery, cabbage, onions, vegetable

marrows, beets, parsnips, and turnips, made in New York State during the period from December, 1943, to January, 1944.

Reports on disease of vegetable crops.—*Plant Dis. Reptr*, xxvii, 24, pp. 662–681, 1943. [Mimeographed.]

The following items, *inter alia*, occur in these reports. G. M. Watkins states that the most serious disease of vegetables present in Zavala and Dimmit counties, Texas, is caused by aster yellows virus on carrots [*R.A.M.*, xxii, pp. 10, 51]. Examination of numerous commercial plantings in the vicinity of Crystal City, Winter Haven, Carrizo Springs, and Asherton showed that the percentage of carrot plants presenting the symptoms of the disease ranged from 0 per cent. in young fields to about 80 per cent. in fields of nearly mature plants. As a rule, carrots under three months old did not show symptoms. Several fields estimated at about three months old contained from under 1 to about 4 per cent. plants with yellows symptoms. In almost mature fields the percentage of affected plants ranged from 35 to 55 per cent. *Lactuca scariola* was present in and round most fields, and almost always appeared to be affected. *Ximinesia encelioides* was found in or near some fields, and in many cases bore symptoms of the disease. An endive field and an adjoining field of young lettuce showed occasional plants that appeared to be affected [ibid., xx, p. 337]. H. W. Larsh states that in the area concerned (Winter Garden region) infection of carrots averages 30 per cent. The disease was also found, though to a limited extent, in the Lower Rio Grande Valley near Mission and Santa Rosa. The insect vector [*Macrosteles divisus*] was present in every infected field.

E. W. Bodine states that *Uromyces fabae* was found on peas for the first time in Wyoming, on a few plants at Laramie.

H. L. Barnett reports that a small field of rhubarb in the coastal area of central California showed heavy infection by rust (*Puccinia phragmitis*) [ibid., xiv, p. 53], the affected leaves also bearing spots due to *Phyllosticta straminella* [ibid., xvii, p. 732].

Larsh (H. W.). **Aster yellows and other Carrot diseases in the Texas Winter Garden region.**—*Plant Dis. Reptr*, xxviii, 3, pp. 91–92, 1944. [Mimeographed.]

In addition to information already noticed, the author states that the carrot variety Danver Half Long, besides Chantenay and Imperator, was found to be susceptible to aster yellows virus [see preceding abstract].

Leaf blight (*Alternaria carotae*) [*R.A.M.*, xxii, p. 343] was more prevalent in the Winter Garden region of Texas, very few carrot fields being completely free from disease. Considerable yellowing and death of the foliage was observed in La Salle, Uvalde, and Dimmit Counties.

Leaf spot (*Cercospora carotae*) [ibid., xxii, p. 285] was observed in two or three plantings, but caused only negligible losses, even in the most severely affected planting noted, near Carrizo Springs in Dimmit County.

Kleczkowski (A.) & Watson (M[arion] A.). **Serological studies on Sugar-Beet yellows virus.**—*Ann. appl. Biol.*, xxxi, 2, pp. 116–120, 1944.

In studies on the virus of sugar beet yellows [*R.A.M.*, xxii, p. 123] specific antisera were prepared against the sap of a naturally infected plant at Rothamsted by injecting rabbits intraperitoneally at weekly intervals with 5 ml. clarified sap. In the sap the antigen was destroyed by keeping for two to three days at room temperature, or by heating for ten minutes at 52° C. It was unaffected by P_H changes between 5 and 9. In detached leaves at room temperature it remained unchanged for at least six days, but the ability of *Myzus persicae* to transmit it from these leaves fell considerably in four days. Freezing clarified sap and thawing after 24 hours did not affect serological activity or visibly alter the appearance of

the sap. Dialysis of the clarified sap in a cellophane sac against distilled water for three hours at room temperature had no effect on serological activity or appearance, but when the dialysed sap was frozen and thawed it failed to precipitate with antiserum, though its appearance remained unchanged. The addition of 1 per cent. sodium chloride or 2 per cent. sucrose to the dialysed sap before freezing prevented the destruction of the antigen.

Part of the virus in clarified sap was precipitated by 1/4 saturated, and the whole by 1/3 saturated, ammonium sulphate. A bulky, dark precipitate formed, which redissolved almost completely in a volume of water equal to the original volume of sap. The fluid so obtained, after precipitation with 1/3 saturated ammonium sulphate, did not differ in appearance from the original sap and gave the same precipitin titre. Repeated precipitations with ammonium sulphate gave only a slight decrease in the precipitin titre, but gave no useful fractionation, for all the materials precipitating with the virus re-dissolved.

When clarified sap was centrifuged for one hour at 20,000 r.p.m., about half the virus sedimented, while at double this rate all of it sedimented. The sediment was dark green and closely resembled the precipitate produced by ammonium sulphate; it re-dissolved completely in water. All attempts to concentrate the virus failed. Whether or not the antigen is the virus, the precipitin test is specific and can be used for diagnostic purposes. As many different causes produce yellowing of beet leaves, it is helpful to have a rapid test for yellows. The use of crude sap and the specific antiserum provides this, and the test frequently works well on plants from the field. At present, however, while a positive precipitin reaction can be regarded as proof of the presence of the yellows virus, a negative test does not exclude it.

Rosen (H. R.). **Results of vegetable seed treatment in Arkansas, season 1943.**—*Plant Dis. Reptr*, xxviii, 1, pp. 9–10, 1944. [Mimeographed.]

Treatment of Dwarf Telephone pea seed with semesan at the rate of $\frac{1}{2}$ teaspoonful per lb. in Arkansas during 1943 did not significantly increase the yield, but improved the stands by 35 per cent., so that approximately $\frac{2}{3}$ lb. of treated seeds per 100 ft. row gave as good a stand as 1 lb. untreated. It is concluded that under war-time conditions of seed scarcity and high prices, seed treatment of peas is desirable on account of the resulting economy in seed. Treatment of bean (Asgrow's Stringless Black Valentine and Landreth's Stringless Greenpod) and of maize (Golden Bantam and Golden Cross Bantam) seed with semesan proved of no or little value.

Johnson (F.) & Jones (L. K.). **A report on a study of virus transmission by fungi and nodule bacteria of Peas.**—*Plant Dis. Reptr*, xxvii, 24, pp. 656–657, 1943. [Mimeographed.]

In experiments carried out to test the possibility that fungi and nodule bacteria (*Rhizobium leguminosarum*) of peas may play a part in virus transmission, *Ascochyta pisi* isolated from pea plants showing severe mosaic and *Cladosporium pisicola* from peas with enation mosaic were cultured separately and inoculated into healthy pea plants. No symptoms of mosaic resulted. Similarly negative results were obtained with conidia of *Erysiphe polygoni* from mosaic peas. Experiments were then made with soil-borne fungi, such as *Rhizoctonia*, *Fusarium*, and *Pythium* spp., causing wilt and damping-off of peas, but no evidence of virus transmission was found. In a test with *Rhizobium leguminosarum* and the white clover mosaic complex, in which surface-sterilized pea seed was immersed in a suspension of the bacteria prepared from nodules from viruliferous plants, sown, and the suspension poured over the seed in the soil, one plant developed mottling, and virus was recovered from it. All the plants then inoculated with virus from this plant developed the same symptoms as the original. No plants became diseased among those where

macerated host tissue without bacteria was added to the soil. The result suggests that more work along this line may be desirable.

Glassock (H. H.), Ware (W. M.), & Pizer (N. H.). **Influence of certain soil factors on chocolate spot of Beans.**—*Ann. Appl. Biol.*, xxxi, 2, pp. 97–99, 1944.

During the summer of 1941, beans growing in south-eastern England were extensively damaged by chocolate spot (*Botrytis cinerea*) [*R.A.M.*, xxi, p. 62]. When dry weather had arrested the outbreak, about 100 fields were examined and the degree of attack classified as slight, moderate, or severe. Investigations were then made to ascertain whether severity of attack could be related to the soil factors of texture, P_H value, available potassium, and available phosphorus.

In the area concerned, the heaviest soils were clay loams (heavy loams), and on these damage was generally slight. The lightest soils were fine, sandy loams (light loams), and on these damage was mostly severe. No more definite indication that soil texture might be related to severity of attack was obtained. For the three grades of attack, slight, moderate, and severe, the mean P_H values of the soils were, respectively, 6·71, 6·76, 6·19. These differences are not considered to be significant. No significant relation was found between degree of attack and available potassium.

The range of values for available phosphorus, however, was 1·1 to 4·5 p.p.m. in the 'slight' grade, 0·75 to 3 p.p.m. in the 'moderate' attack, and 0·75 to 1·5 p.p.m. in the 'severe'. Examination of these figures by the method of analysis of variance, and applying the F and t tests showed that the grade means differed significantly. The probability that fields in the 'slight' grade differed significantly in available phosphate from the fields in the 'severe' grade was very high (under 0·01), but less high (0·05 to 0·01) between the 'moderate' and 'slight' grades or the 'moderate' and 'severe' grades.

There is thus a definite relation between severity of attack and the availability of phosphorus in the soil, as measured by the method of analysis used. Where available phosphorus was over 2 p.p.m. damage was usually slight, and where it was under 1 p.p.m. damage was generally severe. For arable crops these values are medium to medium high and low, respectively. As 75 per cent. of the thousands of soil samples examined in south-eastern England contained medium or smaller amounts of available phosphorus, phosphates would seem to be generally necessary to reduce chocolate spot in seasons when the disease is active.

Yu (T. F.). **Fusarium diseases of Broad Bean. I. A wilt of Broad Bean caused by Fusarium avenaceum var. fabae n.var.**—*Phytopathology*, xxxiv, 4, pp. 385–393, 1 fig., 1944.

Considerable damage is caused in Yunnan, China, by a wilt disease of broad beans characterized by a greenish-yellow discoloration and withering of the foliage, followed by the death of the plants, the vascular regions of which, especially the tap-root and stem base, turn brown to dark brown. Inoculation experiments with the causal organism, *Fusarium avenaceum* var. *fabae* n.var., gave positive results when seedlings of a height of several inches and upwards were grown in soil contaminated by a spore suspension. Full particulars are given of the morphological and cultural features of the pathogen on a number of nutrient media. From a comparison of the broad bean fungus with Wollenweber and Reinking's descriptions [*R.A.M.*, xiv, p. 708], it is evident that a close relationship with *F. avenaceum* and its vars. *pallens* and *volutum* is involved: varietal rank must, however, be assigned to the first-named on the grounds of its ability to attack the broad bean.

Ark (P. A.) & Gardner (M. W.). **Carrot bacterial blight as it affects the roots.**—*Phytopathology*, xxxiv, 4, pp. 416–420, 2 figs., 1944.

This is an expanded account of the root scab of carrot (*Phytomonas* [*Xantho-

monas] carotae) in California, the salient features of which have already been described [*R.A.M.*, xxii, p. 88].

NUSBAUM (C. J.). **The seasonal spread and development of Cucurbit downy mildew in the Atlantic coastal States.**—*Plant Dis. Reptr*, xxviii, 3, pp. 82–85, 1944. [Mimeographed.]

The author presents the 1943 reports forming part of the reporting service on the cucurbit downy mildew (*Pseudoperonospora cubensis*) situation, conducted co-operatively by various workers from Florida to Massachusetts since 1941. The year under review is stated to have been an average season with regard to downy mildew. The disease occurred throughout the Atlantic region and its destructiveness appeared to be governed by local weather conditions. It was present on cucumbers in Florida at the usual time, but a dry April delayed its development; it appeared at about the normal date on various crops in South Carolina, causing considerable damage; in North Carolina and the Middle Atlantic States it appeared at the usual time but was not generally serious, largely because of unfavourable conditions; and in the New England States it caused heavy losses on late crops.

CHESTER (K. S.). **Destructive diseases in an Oklahoma Spinach-growing area.**—*Plant Dis. Reptr*, xxvii, 25, pp. 708–710, 1943. [Mimeographed.]

An inspection on 30th November, 1943, of about 1,000 acres of spinach near Muskogee, Oklahoma, showed that downy mildew (*Peronospora effusa*) [*R.A.M.*, xxi, p. 63] was present on almost half the acreage, the damage in individual fields ranging from 1 to 50 per cent. In an 80-acre tract, 50 per cent. loss was estimated at $5,000. The land had been planted to spinach in the springs of 1942 and 1943, but no serious losses had then been sustained. No white rust [blister] (*Albugo* [*Cystopus*] *tragopogonis*) [ibid., vii, p. 110] was present. In another tract, however, *C. tragopogonis* caused 40 per cent. loss, but no downy mildew was present. This was the only tract showing white blister. In other tracts, downy mildew was slight to lacking and white blister absent, but spinach blight due to cucumber mosaic virus [cf. ibid., xix, p. 385; xxii, p. 88] was present in all, damage ranging from 10 to 75 per cent. The loss in Muskogee County alone was estimated at $50,000. The fact that every field possessed pathological characters markedly different from those of other fields in the vicinity indicates that the disease problem is localized on each farm and its solution can be worked out individually with each farmer.

Both white blister and downy mildew cause heavy losses in transit. The optimum temperature range for downy mildew infection is 40° to 50° F.; standing water is necessary, and three hours are required for infection to take place. The spinach, when received from the fields, is dumped into vats of cold water and then basketed with powdered ice. Powdered ice is blown into the car, and the spinach is left for three or four days, without re-icing except on long journeys. The cars thus act as moist chambers, and, assuming the ice melts in a day or two, the temperatures are probably within the range of 40° to 50°. Similar conditions apply for white blister.

The Muskogee outbreaks were associated with a month which had virtually no rain; the temperatures, however, were between 40° and 50°, and many heavy dews occurred. Dry weather retarded growth. Most fields had repeatedly been planted to spinach, at least once, and sometimes twice, a year. There is, locally, no spinach in the vegetative state during summer. The crop regularly overwinters in all the fields. Oospores were abundant in all infected leaves with white blister, but were not found in the case of downy mildew.

Control must be worked out on each farm separately according to the pathological characteristics of that farm and the following general principles: (1) where downy mildew is the main problem, land bearing affected crops should be taken out of spinach for at least a year; (2) where blight is the chief trouble, resistant

varieties such as Virginia Savoy or Old Dominion should be planted; (3) where white blister occurs, the resistant, flat-leaved canning varieties Viroflay, Broad Flanders, King of Denmark, Victory, Zwann's Dark Green Bloomsdale, Zwann's Darkie, Prickly Winter, Harlem Market, and Dark Green Giant Prickly should be planted if spinach is to be grown within a year after an infected crop; (4) all seed should be treated.

MIDDLETON (J. T.). **Seed transmission of Squash-mosaic virus.**—*Phytopathology*, xxxiv, 4, pp. 405–410, 2 figs., 1944.

Squash (*Cucurbita pepo* var. *condensa*) mosaic [cucumber mosaic virus] induces a filiform habit of the leaves, which are frequently reduced to the veinous system, with patches of green mesophyll; they may be distorted, rugose, and mottled, with dark green raised areas, but little or no chlorosis occurs. The few misshapen fruits bear dome-like protuberances, $\frac{1}{4}$ to $\frac{1}{2}$ in. in diameter, often yellow or mottled. Growth is retarded, but the diseased plants are seldom killed by the virus, which was shown by experiments with the White Bush Scallop, Yellow Crookneck, and Italian Marrow or Zucchini from San Diego and Orange Countries, California, to be transmitted by the seed [*R.A.M.*, xiv, p. 6]. Low-grade, light, deformed seed was found to carry a higher percentage of the virus than heavy, well-filled specimens from the same population, the figures in the former case ranging from 0 to 37 and in the latter from 0·62 to 2·22 per cent. The infective principle remains viable for three years in the seed, and no difference was observed in the incidence of transmission between seed samples sown shortly after harvesting or three years later.

Some degree of control may be achieved by the use of seed stocks from mosaic-free fields, and possibly also by the location of planting sites at a distance from the breeding-ground of the insect vectors of the disease (aphids and *Diabrotica* spp.) [ibid., xx, p. 189]. In the case of seed taken from infested fields, the percentage of transmission through this channel may be materially reduced by careful winnowing.

HARRISON (A. L.) & KELBERT (D. G. A.). **Late blight in Florida.**—*Plant Dis. Reptr*, xxviii, 4–5, p. 116, 1944. [Mimeographed.]

Phytophthora infestans is reported to have caused, for the first time, losses of economic importance to eggplants in a field at Fort Myers, Florida, in 1944, inflicting also considerable damage on potatoes and tomatoes in the same field. The loss in eggplants is estimated by the farmer at 25 per cent. of the entire crop, most of it apparently being due to *P. infestans*, although *Phomopsis vexans* [*R.A.M.*, xxii, p. 511] was also present.

Reports on diseases of vegetable crops.—*Plant Dis. Reptr*, xxvii, 25, pp. 713–723, 1943. [Mimeographed.]

In these notes on diseases of vegetables in different parts of the United States during 1943, it is stated that sweet potatoes near Belle Glade, Florida, were affected by a leaf spot caused by *Cercospora ipomoeae* [*R.A.M.*, xv, p. 344], while a similar leaf spot was very prevalent near Homestead.

SHANOR (L.) & TAYLOR (C. F.). **Diaporthe sojae on Cow-peas.**—*Plant Dis. Reptr*, xxviii, 3, p. 81, 1944. [Mimeographed.]

The occurrence of *Diaporthe sojae* [*D. phaseolorum* var. *sojae*: *R.A.M.*, xxii, p. 463] is reported for the first time on cowpeas near Holland, Virginia. The field in which it was found had been planted to soy-beans in 1942 and was adjacent to a field of soy-beans in 1943. Approximately one-fourth of the stems in the field had light-coloured, round spots characteristic of the pycnidial stage of *D. phaseolorum* var. *sojae* (commonly identified as *Amerosporium oeconomicum*), with numerous black pycnidia scattered in them. Measurements of spores and of pycnidia

agreed with those from infected soy-bean stems. The diagnosis was confirmed by C. L. Lefebvre, who also made single-spore isolations from diseased cowpea tissue and found them to be identical with isolates from soy-beans.

LUTHRA (J. C.), SATTAR (A.), & BEDI (K. S.). **Further studies on the control of Gram blight.**—*Indian Fmg*, iv, 8, pp. 413–416, 1943.

During 1939–40, a supply of about 22,000 maunds [808 tons] of seed of the F_8 line of gram [*Cicer arietinum*], which is highly resistant to blight (*Mycosphaerella rabiei*) [*R.A.M.*, xxi, p. 120] and also gives satisfactory yields under the climatic conditions prevailing in the North Punjab, became available to farmers locally. In 1940–1, this seed was sown over an area of about 40,000 acres. The season was marked by abnormal drought, and a widespread outbreak of wilt [*Fusarium orthoceras* var. *ciceri*: ibid., xxiii, p. 325] occurred in many places. F_8 was severely affected, the evidence demonstrating that this line should be used to replace the local types susceptible to blight only in the districts of Rawalpindi, Jhelum, Gujarat, Attock (excluding Mukbad and Lana) and Shahpar (excluding Khushab tehsil), where, if any soil infection by the wilt organism is present, it is so only in a mild form.

In these localities, F_8 should be sown only when the season has become sufficiently cool, i.e., 10 days to a fortnight after the time generally assumed to be best for sowing the local varieties. As far as possible, the initial amount of moisture in the fields to be planted should be the same as for wheat. As F_8 seed is about 50 per cent. heavier than the local types, the seed rate should be increased correspondingly, in order to secure a normal stand.

In places like Ferozepore and Hissar, where gram is grown extensively, blight is rare. Drought is prevalent in these areas, and most of the damage done to the gram is due to wilt or to unfavourable soil factors. In these districts a wilt-resistant variety is required, whereas in localities such as Lyallpur, Lahore, and Amritsar, where blight and wilt both generally exist, a variety resistant to both diseases is needed.

In selection work carried out to find a variety possessing an equally high resistance to blight without the disadvantages of F_8, small-seeded natural hybrid No. 62–18 gave the best performance.

KEHL (H.). **Zur Sporenkeimung von Psalliota campestris.** [On spore germination in *Psalliota campestris*.]—*Planta*, xxxiii, 5, pp. 731–732, 1943.

For years past running cultures of *Psalliota campestris* have been maintained at the Botanical Institute of Leipzig University in connexion with the writer's studies on spore germination in *Psalliota campestris* [*R.A.M.*, xxii, p. 466]. In consequence, the mushroom spores frequently occur as contaminants in other experimental preparations. Recently, for instance, they found their way into hanging drops of orchid stigma mucus, in which they germinated after two to five days to the extent of 95 per cent. Numerous germination tests were then instituted, drops of *Phalaenopsis* stigma mucus being mixed with equal parts of tap water, inoculated with mushroom spores, and affixed with vaseline to concave slides. Although no special precautions were taken to insure sterility, 40 per cent. of the preparations remained free from contamination by extraneous organisms and in these alone 100 per cent. of the mushroom spores germinated, no germination whatever occurring in the others.

KLIGMAN (A. M.). **Control of the truffle in beds of the cultivated Mushroom.**—*Phytopathology*, xxxiv, 4, pp. 376–384, 1 fig., 1944.

The invasion of cultivated mushroom beds by the truffle or weed fungus, *Pseudobalsamia microspora* [*R.A.M.*, x, p. 290; xx, p. 512], is stated to be responsible for

heavy annual losses in the United States. Experiments having shown that the spores of the intruding organism do not germinate at 60° F. (the optimum is 87°), a positive means of control is afforded through maintenance of the temperature at this level, which permits perfectly normal, though somewhat slow, spawn development. Further evidence is cited, from the experiences of growers known to the author, in support of the view that the soil is the primary source of contamination. Since secondary infection does not occur, the application of fungicides is not warranted, and in any case, a number of preparations tested in six-hour exposures failed to destroy the spores of *P. microspora*. Superficial infection of the beds, which is prevalent, may be combated and mushroom production restored by drying up the infested area, followed after at least three weeks by watering in the usual way.

CHAZE (J.). **Essais de production de la Truffe à partir des cultures pures de son mycélium.** [Experiments in Truffle production by means of pure cultures of its mycelium.]—*C.R. Acad. Sci., Paris*, ccxvi, 22, pp. 742–744, 1943.

The writer is carrying out experiments in the production of truffles [*Tuber* spp.: *R.A.M.*, iii, pp. 428, 541; vii, p. 423] by the incorporation into the soil beneath young oaks, at the time of transplanting, of a mixture of mycelium and organic products. The inocûlated roots were extensively branched, coralloid, with subterminal swellings, and enveloped by a mycelial 'mantle', and were thus in all respects comparable to those of truffle-producing oaks. It will be some years before the efficacy or otherwise of this mode of cultivation can be established, but in the meantime attention is drawn to the possibility of inducing unduly heavy infection and thereby killing the young trees. Precautions have been planned to obviate this risk in future trials.

JENKINS (ANNA E.) & BITANCOURT (A. A.). **Histórico de Elsinoë ampelina, o fungo causador da antracnose da Vidéira.** [History of *Elsinoe ampelina*, the fungus responsible for Vine anthracnose.]—*Biológico*, x, 4, pp. 109–114, 1944. [English summary.]

A survey of the history of vine anthracnose (*Elsinoe ampelina*) in South America has disclosed the existence of independent records of the disease dating from 1877, when it was diagnosed by Lefeuvre in southern Chile [*R.A.M.*, xix, p. 366]. The first report of the pathogen from Brazil is that of Goeldi (1888), and in 1910 Puttemans, in a note which was published for the first time in a special number of *Rodriguésia* (1936, issued 1937), described it as the most serious trouble of European vines in that country. Between those years anthracnose was investigated by Campos Novaes and Noack in S. Paulo. Spegazzini observed the disease in Paraguay in 1881 and reported it in 1886, while the records of its occurrence in Argentina, Peru, and Venezuela date from 1896, 1901, and 1934 [*R.A.M.*, xiv, p. 397], respectively.

REICHERT (I.), PALTI (J.), MINZ (G.), & HOCHBERG (N.). **Trials for the control of Grape Vine diseases. 1. Control of downy mildew (Plasmopara viticola). 2. Control of powdery mildew (Oidium tuckeri).**—*Bull. Rehovoth agric. Res. Sta.* 35, 11 pp., 1944.

In the first of these papers (abbreviated translations from the Hebrew) details are given by REICHERT, PALTI, and HOCHBERG of six trials for the control of vine downy mildew (*Plasmopara viticola*) carried out in Palestine. Of the copper sprays tested, Bordeaux mixture (1·5 per cent.) and perenox (0·5 per cent.) gave the best results. Weaker concentrations of these sprays were less satisfactory, and the copper oxychloride preparation cuprogreen (0·5 to 0·75 per cent. spray or 8 per cent. dust) was ineffective. No definite results were obtained as regards the number

of applications required, but treatments at intervals of three weeks were insufficient in seasons when the disease occurred as early as April. The dates on which applications should be made bear no relation to the length of the shoots. All the copper treatments retarded leaf-fall and reduced autumn sprouting, but the extent to which they did so often failed to correspond to their fungicidal efficiency. Copper treatments, it is concluded, exert a direct physiological effect on the vines.

In the second paper (by REICHERT, MINZ, PALTI, and HOCHBERG) four trials are described against vine powdery mildew (*Oidium tuckeri*) [*Uncinula necator*]. Gaza sulphur (extra fine and superfine) was as effective as yellow sulphur (flowers of sulphur), all these forms of sulphur suppressing the disease almost completely. One application was not enough, but two applications were almost as effective as three. The addition of lime at the rate of 3 kg. to 7 kg. sulphur reduced the cost of the treatment without impairing its effectiveness. The lime-sulphur spray, sulphinette, applied at a concentration of 1 per cent. gave excellent control, and may replace sulphur dusts against *U. necator* whenever spraying appears preferable to dusting. Ammonium polysulphide spray (1 per cent.) was slightly less effective. Spraying with a solution of 0·75 per cent. soda and 0·2 per cent. soft soap is not recommended against this disease in Palestine.

MCKINNEY (H. H.). **Genera of the plant viruses.**—*J. Wash. Acad. Sci.*, xxxiv, 5, pp. 139–154, 1944.

After reviewing the nomenclature and classification of viruses, the author proposes to accord them the rank of a division in the Plant Kingdom, to be designated Viriphyta, and gives an outline of his system of binomial classification, which follows, in the main, The International Rules of Botanical Nomenclature. In this system the ten families of Holmes [*R.A.M.*, xviii, p. 607] are consolidated into two, Marmoraceae and Rugaceae, all viruses inducing mosaic and most of those inducing necrosis in the parenchyma tissues falling into the former, and all those tending to cause malformation but not mosaic-mottling, those inducing yellows type of chlorosis, and nearly all those producing phloem necrosis into the latter. Eight of Holmes's generic names are retained, and several new genera, species, and combinations are proposed. The characters of the various orders, families, and genera are described, and a detailed account given of the type species of each genus. A key to the genera is also supplied.

NEERGAARD (P.). **7. Aarsberetning fra J. E. Ohlsens Enkes Plantepatologiske Laboratorium. 1 April 1941–31 Marts 1942.** [Seventh annual report from the phytopathological laboratory of J. E. Ohlsen's widow. 1st April, 1941 to 31st March, 1942.]—15 pp., 1942. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 8–10, pp. 203–204, 1943.]

During the period under review [cf. *R.A.M.*, xx, p. 516], the 5,165 samples of horticultural seeds examined yielded, *inter alia*, the following new records for Denmark: *Alternaria dianthicola* n.sp. on *Dianthus* sp., *A. resedae* n.sp. on *Reseda odorata*, *A. solani* on *Ageratum houstonianum*, *Ascochyta phaseolorum* on beans, *Heterosporium eschscholtziae* on *Eschscholtzia californica*, and *Phyllosticta orobina* on *Orobus vernus*.

MARTYN (E. B.). **Plant Pathological Division.**—*Rep. Dep. agric. Jamaica, 1942–43*, p. 16, 1944.

CROUCHER (H. H.). **Banana Leaf Spot Control Division.**—loc. cit., pp. 16–17.

LEACH (R.). **Mycological work.**—loc. cit., p. 17.

In this report [cf. *R.A.M.*, xxii, p. 237] it is stated that large banana-growers

in Jamaica continue to fight against Panama disease [*Fusarium oxysporum* var. *cubense*], but small farmers tend to be apathetic and the disease is increasing rapidly. The Agricultural Inspectors endeavour to see that control measures are carried out, at least in areas where infection is not yet widespread. In the absence of gas oil, treatment at present consists in cutting down and chopping up diseased plants *in situ*, treating 'followers' similarly, and leaving the infected site in other respects as undisturbed as possible. The use of lime or fire is in many cases impracticable, and lime is of small value. A banana, described as SA1, possessing potential commercial value and said to be immune from Panama disease and highly resistant to leaf spot (*Mycosphaerella musicola*), was produced by an officer of the Agricultural Department. The Imperial Government's guarantee to purchase a fixed number of stems was extended to June, 1945, the price being fixed at 3s. 3d. per count bunch, less 3d. per count bunch to provide for the purchase of materials to control leaf spot.

It has now been ascertained that while the marked black speckling of banana leaves is due to *Chloridium musae*, a more diffuse type, less clearly visible on the leaf, but equally widespread, is due to *Hormodendrum musicola*. *C. musae* was occasionally found causing spotting on old leaves of plantains surrounded by heavily infected bananas.

Bronze leaf wilt [loc. cit.] continued to cause the death of coco-nuts on the north-west coast, but remained confined to the same area as before. Some Barbados sugar-cane seedlings were affected by pokkah boeng [*Gibberella fujikuroi*]. *Glomerella glycines*, a new record for Jamaica, caused damage to soy-bean pods ripening in wet weather. Sooty black spots on sisal [*Agave rigida* var. *sisalana*] were caused by a species of *Piline*. Pimento rust (*Puccinia psidii*) [ibid., xxi, p. 242] remained static during the year. Other new records for Jamaica included *Cercospora brassicicola* on cabbage, *C. apii* on celery, *C. longissima* on lettuce, *C. malayensis* on okra [*Hibiscus esculentus*], and *Phyllosticta batatas* on sweet potato.

In his report on leaf spot, H. H. Croucher states that incidence was little different from that in previous years. Intensity in the eastern parts of the island declined, and there are still small places on the Blue Mountains and in shaded valleys where satisfactory fruit is produced in the absence of spraying. Perenox, used in place of Bordeaux mixture, gave equally good control, with less wear and tear on equipment. During the year, two depots were closed and three additional sub-depots opened, making a total of 13 depots in operation at the end of March, 1943. Monthly inspections were carried out by the spraying instructor. The twelve different types of spraying equipment in use are serviced by the Leaf Spot Committee in the field and at their workshop.

A large percentage of growers failed to draw their materials regularly, but those who did obtained encouraging results from their spraying. In November, 1942, materials were reduced from 10 lb. each of copper sulphate and lime per acre to 10 lb. copper sulphate and 8 lb. lime. Leaf-spot incidence in unsprayed areas during the year seems to have been lowest in April and May, to have increased in June, and to have reached a peak in November and December, after which it dropped during January, July, and March to a stage between moderate and heavy infection. Growers who sprayed regularly maintained commercial control.

The Leaf Spot Mycologist, R. Leach, states that the individual spots can be subdivided at maturity into the following types: (*a*) broad spots surrounded by a dark ring of gum, (*b*) broad spots with a light ring, (*c*) thin, narrow spots, and (*d*) diffuse spots with no ring. Perithecia tend to be formed in increasing numbers from (*a*) to (*d*). The type of spot largely depends on the age of the leaf when the spot is formed. The most important observation made during the year was that abnormally heavy ascospore infection occurs on certain soils during the season

when ascospore infection is normally at a minimum, i.e., between March and August. In one field, uniformly sprayed with Bordeaux mixture (4–4–40) every three weeks, bananas in sections where the soil was highly acid were very heavily infected in summer, whereas plants under 80 yds. away, on less acid soil, showed excellent control. The spotting on the acid soils was typical of normal winter 'tip-spotting' caused by ascospore infection. It was later observed that the leaf spots of bananas grown on the highly acid soils of Jamaica produce perithecia abundantly throughout the year [ibid., xxii, p. 172]. Apparently, the normal metabolism of the plants becomes altered to such an extent on these soils that the metabolism of the fungus is also affected.

Liming of the highly acid soils did not give encouraging results, indicating that the problem is not merely a simple case of acidity or lime deficiency. This was also shown by the abundant production of out-of-season perithecia occasionally on very alkaline soils of poor fertility. No relation was found between abnormal perithecial production and the amount of phosphorus in the soil or plant.

Spraying schedules in Jamaica aim at reducing conidial infection by consistent spraying in summer, so preventing the subsequent development of perithecia that serious winter infection is avoided. Any soil condition which tends to unbalance the normal metabolism of the banana leaf would also seem to induce an abnormal production of perithecia. The problem demands joint research by the soil chemist, plant physiologist, and plant pathologist.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lv, 6, pp. 235–239, 8 figs., 1944.

In these notes on plant diseases in New South Wales it is stated that war-time methods of handling vegetables in bulk have seriously increased losses due to *Sclerotinia* [*sclerotiorum*: cf. *R.A.M.*, xx, p. 194; xxi, p. 440]. Cool, moist conditions in late winter and spring favour the disease in its early stages, especially on the heavier soils. If subsequent storage, at the cannery or in transport, results in carrots or parsnips being kept for several days or weeks, heavy losses in some batches will be inevitable. The grading of contract-growers, according to their reputation for disease-free produce, will assist in reducing losses. In winter and spring only vegetables from selected farms should be transplanted over long distances or stored for long periods.

Soil disinfection appears to be the only sound method of control on infested land, and even then the benefits may not prove lasting. During wartime any such procedure is beyond the scope of most growers in New South Wales. Growers should, however, use clean land, removing and burning any diseased plants that may appear.

If potato plants have attained considerable growth before being attacked by *Rhizoctonia* [*Corticium solani*], the new growth of the top leaves becomes bunched, giving the plant a rosetted appearance. The leaves may turn purple, and the margins curl up. Aerial tubers may form in the leaf axils. Given favourable weather, the disease may kill the plants even at this stage, but if the soil dries out rapidly they may recover, the leaf symptoms disappearing. The development and progress of the disease depend largely on the weather. In general, early-spring plantings suffer most. Control consists in the use of clean seed, rotation, and disinfection of the tubers [ibid., xx, p. 450].

Recommendations are made for the dusting of pea seed to correct faulty germination. With machine-sown seed, where large areas are to be planted to peas for the first time, and when it is intended to treat the seed with a pea-nodule culture, it is advisable to use spergon at the rate of $1\frac{1}{2}$ oz. per bush. seed. Spergon not only protects the seed from decay, but it is compatible with the pea-nodule culture, and has the additional advantage of lubricating the seed and facilitating

sowing with a multiple drill. Growers using a multiple drill on old ground and not treating the seed with a pea-nodule culture should apply agrosan or ceresan at 1 oz. per bush. In small areas, where hand-sowing is practised, a copper oxychloride dust should be used (bunticide, cuprox, oxycop, saltosan, or smutol) at 2 oz. per bush.

New records for the six months ending on 30th April, 1944, include *Phoma betae* and *Sclerotium rolfsii* on beetroot, *Fusarium* sp. on *Claviceps paspali*, *Bacterium marginatum* on *Freesia refracta*, *Botrytis cinerea* on French beans, *Macrophomina phaseoli* on peas, *Bact.* [*Pseudomonas*] *syringae* on golden poplar (*Populus* sp.), and *Alternaria solani* on eggplant.

Fifty-sixth Annual Report of the Kentucky Agricultural Experiment Station for the year 1943.—64 pp., 1944.

In this report [cf. *R.A.M.*, xxiii, p. 192] it is stated that Ky 41A, a new [black] root rot [*Thielaviopsis basicola*]-resistant Burley tobacco variety was grown extensively in Kentucky in 1943, some 20,000 to 30,000 acres being raised, and several crops of seed were certified. Ky 19, also a new black root rot-resistant Burley, yields very highly on rich land, producing about 10 per cent. more than Ky 16. Ky 52 [loc. cit.] was tested extensively; it remained completely free from tobacco mosaic virus in plantings where the common varieties were heavily infected. The quality appeared to be excellent, and the yields good. Several mosaic-resistant Burley strains (N.N.) were isolated and tested in the field in black root-rot soil. The new strains proved to be as resistant to black root rot as Ky 16, the back-cross parent, and none developed mosaic. Mosaic-resistant varieties will have an additional advantage over susceptible ones in that the stalks can be used on tobacco land without risk of spreading mosaic. Mosaic-resistant (N.N.) strains of dark tobacco apparently identical with Little Orinoco, Woods, and Brown Leaf have been isolated. They remained completely unaffected when inoculated, and should prove of great value in parts of western Kentucky where mosaic causes heavy losses.

Tobacco frog eye (*Cercospora* [*nicotianae*]) [ibid., xx, p. 561; xxii, p. 410] is of major importance in some fields every year, causing frog-eye spots on the lower leaves and green spots on the upper. The spores germinate only when in contact with a moist surface or in a saturated atmosphere. Inoculations of water-soaked tobacco leaves with a water suspension of crushed tobacco roots from the bed and the field gave heavy infection, indicating that the fungus may occur on roots as well as leaves.

Confirmation was obtained of the earlier finding that the angular leaf spot [*Pseudomonas angulata*] and wildfire [*P. tabacum*] organisms live through the summer and winter on the roots of tobacco, legumes, wheat, and other cereals, and on certain weeds [ibid., xxiii, p. 281]. The bacteria were isolated from a field of crimson clover [*Trifolium incarnatum*] and a field of redtop [*Agrostis alba*] and red clover [*T. pratense*] two years after a tobacco crop. Soil samples from 38 pastures and other fields where tobacco beds are commonly made and where tobacco had not been planted for years showed that the angular leaf-spot organism was present in more than half of them and the wildfire organism in a few. It is clear that these diseases may arise in most tobacco beds, so that treatment of the beds with copper sulphate-lime is necessary. Under experimental conditions, wheat served excellently as a host when sterile roots were inoculated, while roots of redtop, timothy [*Phleum pratense*], and, in particular, Kentucky bluegrass [*Poa pratensis*] were more resistant. Infection took place on the rapidly elongating zone of tissue just behind the root cap. No lesions were found on any infected root after five days.

Rapport pour les exercices 1940 and 1941. [Report for the years 1940 and 1941.]—*Publ. Inst. nat. Étud. agron. Congo belge*, 152 pp., 1943.

The following are among the items of phytopathological interest in this report [cf. *R.A.M.*, xix, p. 329]. R. Steyaert's studies on the resistance to stigmatomycosis of different cotton selections (*Nematospora coryli* and *Ashbya* [*N.*] *gossypii*) [ibid., xviii, p. 797] were continued, 3,170 bolls having been inoculated in 1940 and 600 in 1941. Strains 145-116 and 145-84 of selection 145-C-55 appeared to be the most resistant to the disease, but notwithstanding this advantage they yield only second-grade cotton in commercial plantings due to the premature opening of the bolls giving ingress to saprophytes which impair the fibre.

Soil inoculation experiments with rice cultures of *Fusarium vasinfectum* were carried out with a view to the development of wilt-resistant cotton strains. Since the material available for this purpose consisted of old, genetically pure lines of Bambesa, the likelihood of success appeared to be remote, but in 1940 a plant, A 6, believed to be a derivative of 270, exhibited a noteworthy degree of resistance, which descended to its progeny in 1941.

A practical interest attaches to the isolation of the toxin or toxins of *F. vasinfectum*, which may be used in preliminary laboratory work to eliminate seedlings unsuitable for further large-scale trials. The crude extract was found to be useless for the purpose in view and a purified crystalline preparation was finally obtained which proved to be highly toxic to the cotton seedlings.

A species of *Rhizoctonia*, probably *R. bataticola* [*Macrophomina phaseoli*], was observed for the first time on coffee roots. Further studies on the biology of *Glomerella* [*cingulata*: ibid., xxiii, p. 62] on coffee showed that the fungus possesses a Melanconiaceous form with uniseptate, hyaline conidia and hyphal fructifications arising directly from conidiophores barely differentiated from the mycelium. Previous conclusions regarding the limitation of certain strains of *G. cingulata* to particular organs of the host appear to be baseless. Actually the fungus (in the *Colletotrichum coffeanum* stage) may be isolated from the green berries, floral buds, and plumules showing no external symptoms of infection, the incubation period of which presumably extends for several months. Hence inoculation experiments on an organ which may or may not harbour the parasite are without significance. Another point of practical importance arising out of these observations is the questionable value of fungicidal treatments applied after the setting of the berries. Under the conditions prevailing at Mulungu the damage caused by *G. cingulata* is not normally extensive, but on the basis of counts of infected 'cherries' on 2,410 bushes of known descent, Local Bronze was placed in the most resistant category and Mysore in the most susceptible.

Stigmatomycosis, associated with *N. coryli* only, appears to assume a particularly severe form on berries setting unduly late and ripening during the dry season.

Damping-off (*R.* sp.) may be responsible for the total failure of *Cinchona* seedbeds: soil disinfection with mercuric chloride or formalin gave a measure of control. A *Fusarium* of the *Elegans* section and a *Verticillium* have been isolated from plants affected by tracheomycosis, but so far inoculation experiments with these organisms have not yielded conclusive results. Root diseases are caused by *Armillariella* [*Armillaria*] *mellea*, *Rosellinia* sp., *Diplodia theobroma* [*Botryodiplodia theobromae*], and *Helicobasidium* sp.

New plantings of *Pyrethrum* [*Chrysanthemum*] *cinerariaefolium* were damaged by a *Rhizoctonia*, while a serious disease of the inflorescences observed at Tshibinda in 1940 is due in the majority of cases to *Botrytis* sp. The brown spots on the flowers were experimentally reproduced. In the Kivu region of the Belgian Congo, as well as in Kenya, a similar disorder is attributed to the excessive humidity of

the rainy season, so that evidently two distinct factors may operate, independently or in conjunction, to produce the same abnormal effect.

Since the adoption of a rational system of spacing and judicious crop rotation, groundnut rosette is no longer a source of serious trouble in experimental plantings and propagation plots. The crop grown during the second half of the rainy season is more susceptible in each year than the early one. None of the 904 plants inoculated with the virus by colonization with *Aphis laburni* remained immune from rosette.

Sclerospora maydis [ibid., xvii, p. 168] was observed on maize for the first time in the Gandajika region, late sowings sustaining the heaviest damage. *Uromyces appendiculatus* caused severe losses in bean plantings.

Buvat (R.). **Phénomènes de dédifférenciation dans les tumeurs corticales produites chez la Tomate.** [Phenomena of dedifferentiation in the cortical tumours produced in the Tomato.]—*C.R. Acad. Sci., Paris*, ccxvi, 2, pp. 127–129, 1943.

A cytological study of the tumours induced on tomato stems by inoculation with *Phytomonas* [*Bacterium*] *tumefaciens* revealed the total dedifferentiation of the cortical cells into primary meristematic cells, passing through an intermediate stage of the cambial type.

Pal (B. P.). **The Pusa Wheats: the Wheat-breeding work of the Imperial Agricultural Research Institute.**—*Emp. J. exp. Agric.*, xii, 46, pp. 61–73, 1944.

In discussing the wheat breeding investigations carried out at New Delhi [cf. *R.A.M.*, xxii, p. 198], the author reviews the earlier investigations made before the present phase of the work commenced in 1934 and points out that even forty years ago the annual loss sustained in India from the black, brown, and yellow wheat rusts (*Puccinia graminis tritici*, *P. triticina*, and *P. glumarum*) was estimated at Rs40,000,000. As infection is started each year in the plains by spores from the hills, the Imperial Council of Agricultural Research restricted the scope of the present work to the hill regions, and is now considering the breeding of rust-resistant barleys for such stations.

The investigations, carried out in collaboration with K. C. Mehta, were taken up in two stages, the first being the breeding of varieties resistant to one or other of the rusts, and the second the synthesis of varieties resistant to all three. The first stage is nearing completion. Varieties respectively resistant to all the races of yellow and brown rust known to occur in India [ibid., xx, p. 292] have been built up, and others resistant to all the Indian races of black rust will probably soon be developed.

Progress against black rust was slow, because when the work was begun no variety of *Triticum vulgare*, indigenous or imported, was known that was resistant to all the Indian races, but eventually a Kenya wheat, to which the accession number E 144 was given, was found which showed satisfactory resistance. Later, another Kenya wheat (E 220) was found with high resistance. A double cross has been planned, which, it is hoped, will result in the production of varieties with the desired characteristics.

The next most serious disease of wheat in India is loose smut (*Ustilago tritici*) [cf. ibid., xix, p. 583]. Tests to determine the resistance or susceptibility of the wheat strains bred at the Imperial Agricultural Research Institute, and of other wheat varieties likely to be useful in breeding work were begun in 1936 by B. B. Mundkur [ibid., xxi, p. 327]. A few wheats, including Pusa 114, were immune, while others, including Pusa 120 and Pusa 165, were resistant. These three were derived by crossing from Federation, which proved to be immune in the same tests. On the other hand, some of the chief commercial wheats, including Pusa 4, Pusa 12, Pusa 52, the Punjab strains C518 and C519, and the United Provinces strain,

Cawnpore 13, are highly susceptible. Attempts to select resistant sub-strains within some partially susceptible varieties were occasionally successful, showing that varieties apparently homozygous for morphological characters are not necessarily pure for disease resistance. Pusa 120 showed 9·7 per cent. susceptibility in the first year's tests, but the seed 'screened' or 'sieved' by subsequent selection gave immune plants only.

Pusa 4, Pusa 80-5, and Pusa 111 were highly resistant to *Urocystis tritici* [loc. cit.], but in most cases the resistant varieties were susceptible to loose smut. Pusa 165 is resistant to both diseases.

It is hoped shortly to undertake the testing of wheat varieties for resistance to Karnal bunt (*Neovossia indica*) [ibid., xxiii, p. 338].

STAKMAN (E. C.) & LOEGERING (W. Q.). **The potential importance of race 8 of Puccinia graminis avenae in the United States.**—*Phytopathology*, xxxiv, 4, pp. 421–425, 1 map, 1944.

During 1943, race 8 of *Puccinia graminis avenae*, with which 10 may be combined for practical purposes [*R.A.M.*, xxiii, p. 173], increased in an alarming manner in the United States, the total number of isolates amounting to 421 as compared with 251 in 1939 and 232 in 1942. The importance of this change in distribution lies in the ability of races 8 and 10 to produce severe infection on Richland oats and various crosses between that variety and Victoria, e.g., Vicland, Boone, and Tama. The two races under observation have been fairly widespread, though not abundant, for some years past, and the possibility of a still further increase in prevalence must therefore be recognized.

CHESTER (K. S.). **The decisive influence of late winter weather on Wheat leaf rust epiphytotics.**—*Plant Dis. Reptr, Suppl.* 143, pp. 133–144, 1943. [Mimeographed.]

It has been shown by an analysis of the relevant meteorological statistics covering 16 epidemic years and 17 of mild infection that the intensity and virulence of wheat leaf [brown] rust [*Puccinia triticina*] are governed almost exclusively by the temperatures and precipitation during the late winter months (December to March in Oklahoma and December to April in Illinois and Iowa), and that the weather in the two following spring months, those in which rust becomes obvious, has very little decisive effect on rust development. The apparently inconsistent weather-rust relationships obtaining in the south-west in 1942–3 and in Illinois from 1922 to 1926 are explicable on this basis. This paradoxical weather-rust relationship is due to the necessity for the rust to increase from its minimum winter prevalence by a logarithmic series of uredo generations, the first of which occurs at a time when the absolute amount of infection is so small as to be almost imperceptible. At this stage, temperatures and rainfall are so near the lower threshold permitting rust multiplication that minor fluctuations in the weather may turn the balance for or against this process. Hereon depends the prevalence of *P. triticina* at the opening of spring, after which time the logarithmic increase of the rust is not appreciably accelerated or retarded by meteorological variations, since the weather conditions during these months are regularly within the range favouring rust development.

Practical considerations arising out of the foregoing analysis include the use of rusted wheat (higher in protein than the normal) as hay; cultivation on wheat land of a summer crop in years when an epidemic is forecast by the close of the late-winter period; attention to the importance of (*a*) late-winter applications of sulphur dust for experimental or commercial rust control, and (*b*) artificial irrigation at the same time of year to induce local epidemics in wheat variety-testing nurseries.

CHEREWICK (W. J.). **An improved method of determining the smut spore load on cereal seed.**—*Canad. J. Res.*, Sect. C, xxii, 3, pp. 120–126, 1 pl., 1 fig., 1944.

The determinations of the smut (*Tilletia* spp.) spore loads present on cereal seed samples by washing and centrifuging having shown that, owing to variability in the surface tension and viscosity of the washings, and, apparently, to some electrical effect, the spore counts were unreliable, the author devised an improved method of making such determinations. Forty gm. seed-grain are placed in a 500 c.c. Erlenmeyer flask and 60 c.c. distilled water containing 0·1 per cent. of a proprietary wetting agent (an ester of sulphonated bicarboxylic acid dispersed in water) are added. The flask is then shaken 30 times, every tenth stroke being made upwards with the flask held upside down. Next, 10 c.c. of the washings are at once poured into a centrifuge tube, and centrifuged for four minutes at 2,400 r.p.m., the supernatant liquid then being siphoned off to within 0·3 c.c. To the residue 0·2 c.c. of a 4 per cent. gelatine solution maintained at 45° C. is added, to make a total of 0·5 c.c. The spores are then dispersed in this medium by stirring. If the sample is dirty, distilled water and gelatine are added in the proportions mentioned above to double or treble the amount of the dispersion medium. A loopful of the residue is withdrawn, placed on a special slide (similar to a haemocytometer, with a 5 m.m. counting square and a film 130μ thick), and covered with a cover glass. If the spores are numerous, eight microscopic fields are counted; if few, eight swaths across the square are counted. The spore load is determined by comparing the counts with those of standards made for each kind of grain by counts on artificially smutted samples carrying a range of known spore loads.

DILLON WESTON (W. A. R.). **Bunt of Wheat.**—*J. Minist. Agric.*, li, 6, pp. 264–265, 1 fig., 1944.

This is a brief, popular account of wheat bunt (*Tilletia caries*) and its control by seed treatment with organo-mercury dressings. The life-history of the fungus is depicted in a chart.

BRANDWEIN (P. F.). **Seedling invasion of the covered smut of Oats.**—*Phytopathology*, xxxiv, 5, pp. 481–484, 1 fig., 1944.

Continuing his studies on the invasion of oats seedlings by covered smut (race 7 of *Ustilago kolleri*) [*R.A.M.*, xx, p. 108], the writer inoculated dehulled seeds and 24-hour-old seedlings of the Monarch and Markton varieties with dry chlamydospores and allowed them to germinate at 20° C. in sand with a moisture content of 20 per cent. of its water-holding capacity; the plants of the former series were removed for examination after 48 hours and those of the latter after 72. Only about 10 per cent. of the spores germinated on the seedling inoculated at 24 hours. The total number of invasions in the 143 seedlings under investigation was 922, of which 390 were effected directly from the chlamydospores and 532 through hyphal fusion or by uncertain means; the latter group comprised only 52 cases involving apparent sporidial fusion, though this process was completely observed in the mat of smut spores sometimes found in the sand beside the seeds.

Various points in connexion with the experimental data require further elucidation, but in the meantime it may be noted that promycelial penetration directly from chlamydospores of *U. kolleri* is more extensive than has hitherto been supposed.

TWYMAN (E. S.). **Manganese-deficient soils.**—*Nature, Lond.*, cliv, 3906, p. 336, 1944.

Using a slightly modified form of Sherman, McHargue, and Hodgkiss's method (based on Leeper's [*R.A.M.*, xv, p. 8]) of identifying (*a*) manganese-deficient neutral and alkaline soils, (*b*) strongly acid soils that will become manganese-

deficient when limed to near neutrality, and (*c*) soils likely to contain such excess of available manganese as to be toxic to plants (*Soil Sci.*, liv, p. 253, 1942), the authors investigated three types of soil: (1) a light, black, heath soil from Shropshire with a strongly acid reaction, (2) a heavy Lias clay from south Warwickshire with an almost neutral reaction, and (3) a garden loam from Birmingham with P_H over 7. Manganese-deficient oats were growing on the first two and healthy oats on the third. The Shropshire soil samples had P_H values between 6·4 and 7·9, due to the heavy liming, and were definitely manganese-deficient. The Lias soil had P_H values between 6·3 and 7. The high P_H value of the Birmingham soil was due to heavy liming.

The Shropshire soil samples showed 2·8 to 8·2 p.p.m. of easily reducible manganese, the Warwickshire samples 25·6 to 43·7 p.p.m., and the Birmingham soils 98·2 to 183 p.p.m. These figures show that the easily reducible manganese is the important fraction in identifying manganese-deficient soils. This supports the conclusion of Sherman and his co-workers that manganese-deficient soils are identifiable by this method.

Klotz (L. J.). **A simplified method of growing plants with roots in nutrient vapours.**—*Phytopathology*, xxxiv, 5, pp. 507–508, 1 fig., 1944.

The apparatus assembled to facilitate the study of *Phytophthora* infections and of the toxicity of various concentrations of nitrite and other ions on citrus [*P. parasitica* and *P. citrophthora*] and avocado [*P. cinnamomi*] roots [*R.A.M.*, xxiii, p. 106] consists of a 12 l. cylindrical glass jar containing 3 l. or less of nutrients, which is re-circulated in vapour form over the roots of the plants suspended through holes in the cover with a De Vilbiss atomizer, operated by air pressure. A glass tube attached to the intake of the atomizer extends to the bottom of the jar, and clogging of the atomizer by sloughed root material is obviated by filtering the nutrient entering the intake through Pyrex glass wool. Only a small amount of solution escapes as vapour through the holes of the plant support. The equipment is also adaptable to use with the continuous-flow method of supplying nutrient (*J. agric. Res.*, liii, pp. 433–444, 1936; lvi, pp. 73–80, 1938).

Fraser (Lilian). **Phytophthora root rot of Citrus.**—*Agric. Gaz. N.S.W.*, lv, 5, pp. 197–200, 7 figs., 1944.

The information presented in this account of the root rot of citrus caused by *Phytophthora citrophthora* has already been given elsewhere [*R.A.M.*, xxii, p. 133; xxiii, p. 175].

Govande (G. K.). **Breeding for resistance to Cotton root rot in Gujarat.**—Abs. in *Proc. Indian Sci. Congr.*, xxix, Sect. xi, p. 217, 1942. [Received May, 1944.]

Investigations are in progress in Gujarat on the breeding of a cotton strain resistant to root rot (*Macrophomina phaseoli*) to replace the susceptible Broach 9 (*Gossypium herbaceum* var. *frutescens*) [*R.A.M.*, xvii, p. 34 *et passim*]. Preliminary trials established the partial resistance of a bulk of survivors collected from infested fields in the village of Kharkhadi near Baroda. Continuous selection on this material has resulted in the development of families with a mortality of only 20 to 30 per cent. compared with 95 per cent. in Broach 9. The spinning value of these lines, however, is very low, so that cultivators are unlikely to find them profitable. Among the factors complicating the work of breeding for resistance to root rot in *G. herbaceum* var. *frutescens* are the extreme heterogeneity of the disease in the soil, simultaneous selection for other characters, the dominance of resistant genes, and a considerable heterozygosity in this respect of the local material. The next steps are to be directed towards a combination of the resistance

of the Kharkhardi selections and of Rozi (*G. arboreum* var. *typicum*) with the quality of *herbaceum* strains by hybridization.

DESCHIENS (R.), LAMY (L.), & VAUTRIN (E.). **Essais pratiques de prophylaxie de l'anguillulose des végétaux par l'emploi d'Hyphomycètes prédateurs.** [Practical trials in the prophylaxis of plant nematodes by predaceous Hyphomycetes.]—*C.R. Acad. Sci., Paris*, ccxvi, 15, pp. 539–541, 1943.

In order to test the practical utility of certain predaceous Hyphomycetes in the control of the larvae of *Heterodera marioni*, a ubiquitous nematode attacking the roots of over 600 species of plants, two lots of Gloire de Lorraine *Begonia* were planted in pots, namely, 21 protected by the incorporation with the compost of 1 per cent. cereal chaff cultures of *Dactylella bembicodes* and *Arthrobotrys oligospora* [*R.A.M.*, xxii, p. 306] and 18 left untreated. The incidence of eelworm infestation in the protected and control series amounted to 3 out of 21 (14 per cent.) and 8 out of 18 (44·4 per cent.), respectively, while the numbers of tumours per plant were 5 and 85, respectively. Of the 11 plants supplied with cultures of *D. bembicodes*, the one infested bore a single tumour on the root-collar, while in the *A. oligospora* series, each of the two infested plants bore five excrescences on the extremities of the roots.

ADAM (D. B.) & PIPER (C. S.). **The use of zinc for Flax.**—*J. Dep. Agric. S. Aust.*, xlvii, 10, pp. 422–426, 2 figs., 1944.

Flax growing in several parts of South Australia has been affected since 1941 with a die-back apparently due to zinc deficiency [cf. *R.A.M.*, xxi, p. 483]. Early in spring, patches of plants remain stunted, though later on the affected plants catch up fairly well with the healthy ones. The stalks of the diseased plants are spindly and less freely matured than those of normal ones, and are, actually, second shoots which have developed from the base of the plant, the first shoot having died at the tip. The stunting results from the early death of the leading shoot. Side shoots develop at the base, but in the spring are still very short. In severe cases, the tips of the secondary shoots may also die, but as a rule at least one shoot flowers. Before the tip of the primary shoot dies some leaf-spotting occurs, varied in appearance and colour. It is not known how much of this is due to zinc deficiency. The roots show no marked symptoms, but their development is generally somewhat limited. In some cases die-back of the primary shoot occurs at a later stage. In others the tip does not die, but growth is arrested, and the topmost leaves are spotted and yellowish; later, growth is resumed and the position at which arrest occurred is shown by the degree of leaf-bunching and the tendency for affected leaves, especially spotted ones, to drop.

The condition was first noted in the mid-northern area on heavy, dark lime-humus soils and has since been found on less heavy types and on 'mallee' [*Eucalyptus* bushwood] soils fringing this lower northern area. It has also been observed in the Strathalbyn area.

In 1943 field tests were conducted at two centres, in which agricultural zinc sulphate, zinc concentrate, and zinc calcine were applied at different rates, the first at 10, 20, and 30 lb. per acre, and the others at rates containing equivalent amounts of zinc. Superphosphate at 1 cwt. per acre was applied to all plots. At all stages of growth the effects of the zinc calcine and the zinc sulphate were evident, but little or no difference was noted between the different rates of application. The zinc concentrate appeared to have only very slight effect. On 27th September the results at one centre showed that the yields per acre (dry weight) were 1,400, 1,240, and 760 lb. for zinc sulphate, zinc calcine, and zinc concentrate, respectively, as against 710 lb. for the plots receiving superphosphate alone.

There is at present no detailed information as to what parts of South Australia are likely to benefit from zinc applications for flax-growing. Individual growers must determine for themselves whether they are likely to obtain a beneficial response. For the present it is suggested that growers should use a superphosphate and zinc mixture containing agricultural zinc sulphate or zinc calcine at a rate equivalent to 20 lb. agricultural zinc sulphate per acre.

Waterhouse (W. L.) & Watson (I. A.). **Further determinations of specialization in Flax rust caused by Melampsora lini (Pers.) Lev.**—*J. roy. Soc. N.S.W.*, lxxvii, pp. 138–144, 1943.

Further studies on specialization by *Melampsora lini* in Australia [*R.A.M.*, xxi, p. 256] have resulted in the determination of six physiological races. Race A is the one already recorded for Australia [loc. cit.]. It is essentially a rust of linseed varieties, on which it often causes serious damage. It is not at present important on commercial fibre flax varieties, though it is present in areas where these are grown. It occurs on *Linum marginale,* and is particularly virulent on Indian linseed varieties, of which Punjab, Bombay, and Morocco are very heavily attacked.

Races B, C, D, and E are serious pathogens on fibre flax varieties. They resemble Flor's race 21 [cf. ibid., xix, p. 655]. B and C are similar, except for a sharp differentiation by the Argentine 705–1 flax variety, which gives immune and susceptible reactions, respectively. Races D and E differ from B and C in that Kenya 709–1 is fully susceptible to them though it gives a variable or mixed reaction to B and C. At high temperatures the reactions of D and E are variable. Separation between D and E is effected by Argentine 705–1. No other variety has yet been found which will distinguish satisfactorily between B, C, D, and E. The authors agree with Flor that Argentine 705–1 is influenced by environmental conditions; when inoculated with B, C, D, and E it has shown about 20 per cent. of mixing. F has affinities with A, but it is clearly separated from it by the reaction on Buda 270–1. This race has so far been found only on *L. marginale* in Victoria and South Australia.

In contrast with the race determinations made in the United States, J.W.S. C.I. 708–1 is fully susceptible to races B, C, D, and E. A noteworthy feature of the six Australian races is that Ottawa 770B and Argentine C.I. 462 are uniformly immune from them.

When two different isolates of the teleutospores of race A were used, the aecidial stage on Punjab linseed gave reactions similar to those of the original uredospore material, indicating that some isolates of this race are homozygous.

The distribution of the six races in Australia, Tasmania, and New Zealand up to 31st December, 1942, is tabulated. That only race A occurred in New South Wales is explained on the ground that only linseed varieties are grown in this State. The uredospores of race A appear to tolerate much higher temperatures than those of the other four flax-attacking races and to survive longer periods of artificial storage at low temperatures. Victoria yields all six races.

Two species of wild flax are found in Australia. Of these, *L. gallicum* was not found to be infected, and attempts to infect it with races A, B, C, D, and E failed. *L. marginale*, on the other hand, plays an important part as a perennial host and yielded A, E, and F. Some evidence was obtained that certain strains of wild flax may serve as useful differentials of races.

Flax and linseed varieties found resistant to the different races (less than 10 per cent. of plants susceptible) are listed. A number are resistant to all six. If they become rusted when grown in various localities, the indication will be that yet another race has been found.

Crossing is in progress to combine the full resistance of certain of these parents with other desirable qualities.

Haskell (R. J.), Leukel (R. W.), & Otten (C. J.). **Organized seed treatment to improve stands and conserve seed a part of the Government's war-time Hemp program.**—*Plant Dis. Reptr*, xxvii, 12–13, pp. 252–253, 1943. [Mimeographed.]

The results of preliminary co-operative experiments in the seed treatment of hemp, the cultivation of which is being widely extended in the United States to combat the prevailing fibre shortage, indicated an average increase of 60 per cent. in the emergence of plants from seed disinfected with organic mercury [cf. *R.A.M.*, xxiii, p. 63], while in some cases the rate was nearly doubled. Such convincing evidence in favour of seed treatment decided those entrusted with the execution of the hemp fibre programme to treat all Kentucky and Chilean seed intended for the new producing areas. No proper facilities for the work being available in the Kentucky warehouses where the seed was stored, arrangements were made for the treatment to be carried out at suitable plants in various towns of Indiana, Illinois, and Iowa served by the railways conveying the material to its northern destinations. At most of these plants semesan jr. was applied to the seed at a dosage of 1½ to 2 oz. per bush., the total quantities of Kentucky and Chilean produce treated being 200,000 and 8,000 bush., respectively. There was a general improvement in germination in tests at the Bureau of Plant Industry Station, Beltsville, Maryland, conducted four to six weeks later, and the precaution is believed to have been largely responsible for the vigour of the stands in the face of the abnormally unfavourable weather conditions obtaining in the areas under production during the spring of 1943. This is probably the first instance of the application to virtually the entire national supply of a valuable crop of seed treatment against soil- and seed-borne pathogens.

Dodge (B. O.) & Rickett (H. W.). **Diseases and pests of ornamental plants.**—xi+638 pp., 194 figs., 1 diag., 1 graph, Lancaster, Pa, Jaques Cattell Press, 1943. $6.50.

The first part of this book, which is designed to meet the needs of amateur and professional gardeners as well as of the commercial grower, deals with the symptomatology, etiology, and control of diseases and pests of ornamentals in general, while in the second the available information on the recognition and treatment of the pathogens of some 600 garden and greenhouse plants is summarized under the individual hosts, arranged in the alphabetical order of their scientific names.

Brierley (P.). **Viruses described primarily on ornamental or miscellaneous hosts.**—*Plant Dis. Reptr, Suppl.* 150, pp. 410–482, 1944. [Mimeographed.]

The following 74 viruses are listed in alphabetical order according to the generic names of their principal hosts, with notes on their synonymy, common names, geographical distribution, host range, mode of transmission, properties, other pertinent observations, and the relevant literature, as part of a project of the Committee on Virus Classification and Nomenclature of the American Phytopathological Society dealing with the codification of published information on these subjects: *Abutilon* variegation, *Acer* (maple) variegation, *Anemone* alloiophylly, *Anthurium* mosaic, ash variegation, aster (*Callistephus*) yellows, *Atropha* mosaic, *Boltonia* streak, California aster (*Callistephus*) yellows, *Camellia* yellow spot, *Canna* mosaic, carnation mosaic, *Cephalanthus* mosaic, *Dahlia* mosaic, *Daphne* mosaic, *Datura* mosaic, *Datura* 'quercina', *Delphinium* ring spot, elder mosaic, elm mosaic, elm phloem necrosis, *Emilia* variegation, *Epiphyllum* mosaic, *Euonymus* variegation, *Gladiolus* mosaic, *Holodiscus* witches' broom, hop chlorotic disease, hop infectious sterility, hop mosaic, hop nettlehead, horse-chestnut variegation, *Hydrangea* virescence, *Hyoscyamus* mosaic, *Ilex* variegation, *Iris* mosaic,

Jasminum variegation, *Laburnum* variegation, lily rosette, lily symptomless, lily of the valley mosaic, *Lonicera* variegation, *Matthiola* mild mosaic, *Matthiola* severe mosaic, *Narcissus* mosaic, *Narcissus* white streak, oleander variegation, *Ornithogalum* mosaic, passion fruit woodiness, passion fruit variegation, peony mosaic, *Pelargonium* leaf curl, *Pelargonium* mosaic, *Peperomia* ring spot, *Petunia* mosaic, *Phlox* streak, *Phytolacca* mosaic, *Pittosporum* variegation, *Primula* mosaic, privet variegation, *Prunella* mosaic, *Prunus* rough bark, *Ptelea* variegation, *Rhamnus* variegation, *Robinia* brooming, rose mosaic, rose streak, rose wilt, *Rumex* mosaic, *Sorbus* variegation, sweet pea streak, *Tabebuia* witches' broom, and tulip breaking.

SILBERSCHMIDT (K.). **Estudos sôbre a transmissão experimental da 'clorose infecciosa' das Malvaceas.** [Studies on the experimental transmission of 'infectious chlorosis' of the Malvaceae.]—*Arq. Inst. biol. S. Paulo*, xiv, 9, pp. 105–156, 7 pl., 1943. [English summary.]

A comprehensive, tabulated account is given of the author's observations and experiments on the transmission of infectious chlorosis of *Sida acuta* var. *carpinifolia*, *S. rhombifolia*, and *S. cordifolia*, all common in the State of São Paulo, Brazil, and of two cultivated ornamentals, *Abutilon striatum* and its var. *spurium* [*R.A.M.*, ix, p. 385; xiii, p. 447].

Attempts at the transmission of the causal virus from chlorotic to healthy plants of *S. acuta* var. *carpinifolia* and *S. rhombifolia* by sap inoculation gave negative results, but the infective principle was readily conveyed by grafting from diseased to sound components of the former variety, a period of two days sufficing for the establishment of the virus in the latter species. Exposure of the viruliferous scion, before grafting, to high temperatures tends to delay the appearance of symptoms in the stock. The virus travelled more swiftly in a basipetal than in an acropetal direction. Plants grown from seed of diseased plants of *Sida* failed to yield any symptoms whatever.

In a second series of tests, involving interspecific grafts, healthy stocks of *S. rhombifolia* contracted infection with equal facility from chlorotic scions of the same host, *S. acuta*, and *S. cordifolia*. *S. acuta* stocks, however, developed graver symptoms after grafting with diseased scions of the same species than in the trials with *S. rhombifolia*, similar observations applying to *S. acuta* scions grafted on infected stocks of the same species or *S. rhombifolia*.

A third series of experiments was conducted with intergeneric grafts between *A.* and *S.* spp. Diseased scions of *A. striatum* var. *spurium* transmitted a virus capable of inducing the typical chlorotic symptoms in stocks of *S. rhombifolia*, whereas those of *S. acuta* var. *carpinifolia* reacted only very faintly to the same treatment. There were very few instances of successful transmission of the virus from diseased *S.* to healthy *A.* spp.

It is concluded from these data that the viruses responsible for infectious chlorosis in different species of Malvaceae are identical, but that passage through the zone of contact between stock and scion, in the case of heteroplastic grafts, results in a weakening of virulence, possibly associated with (*a*) insufficient quantities of the virus, (*b*) the absence of a second virus component necessary for the formation of a 'complex', (*c*) the lack of an 'activator' substance, or (*d*) the non-aggregation of the virus particles.

Finally, attention is drawn to the susceptibility to reinfection with the virus of infectious chlorosis of such organs of the grafted plants as exhibited no symptoms in the original experiments.

SMITH (F. F.) & BRIERLEY (P.). **Ornithogalum mosaic.**—*Phytopathology*, xxxiv, 5, pp. 497–503, 1 fig., 1944.

A double-flowered variety of *Ornithogalum thyrsoides* received from an Oregon

grower in 1940 was affected by a fine, pale and dark green mottling of the leaves, turning grey or yellow and becoming more prominent with advancing maturity. The flower stalks were sometimes strongly marked with sharply contrasting pale and dark green blotches, while thin, longitudinal streaks commonly developed in the white perianth segments. Similar mosaic patterns were observed in *O.* and *Lachenalia* leaves in Alabama, and on *Galtonia* and hyacinth in Oregon. The *O.* virus could be transmitted only with difficulty by means of the sap, but a high degree of efficiency in this respect was shown by *Aphis gossypii, Macrosiphum lilii, M. solanifolii,* and *Myzus persicae, M. circumflexus* being slightly less active than the other aphids. The numbers of plants infected mechanically and by the five species of aphids, in the order given above, were 6 out of 75, 5 out of 5, 5 out of 5, 5 out of 5, 46 out of 46, and 4 out of 10, respectively, while the corresponding minimum incubation periods were 32, 17, 10, 31, 10, and 34 days, respectively. The host range of the virus, as hitherto established, embraces only *Galtonia candicans,* Yellow Hammer hyacinth, and *L.* sp., with the possible addition of *Eucomis.* The common name of *Ornithogalum* mosaic and the technical designation of *Marmor scillearum* are proposed for the virus under observation.

Weiss (F.). **Rhododendron dieback and canker.**—*Plant Dis. Reptr,* xxvii, 12–13, p. 254, 1943. [Mimeographed.]

Three-year-old grafted *Rhododendron* plants from a Maryland nursery developed a wilt followed by death of the current season's shoots in the suburban districts of Washington early in July, 1943. A species of *Phytophthora,* tentatively referred (with the concurrence of C. Drechsler) to *P. cactorum* [*R.A.M.*, xiv, p. 173], was isolated from the diseased material, its perpetuation having apparently been effected in the 1942 internode. Portions of the infected bark immersed in water also bore numerous acervuli of the *Gloeosporium* type containing salmon-pink, aseptate, cylindrical conidia, 12 to 16 by 4·5 to 5·5 μ, borne on conidiophores measuring 18 to 20 by 4 μ, which were exuded in cirrhi under humid conditions: over some of the acervuli dark setae, 35 to 80 by 5 to 6 μ, were irregularly scattered. These features are characteristic of the conidial stage of *Glomerella cingulata,* the behaviour of which in this instance was quasi-parasitic, since it formed cankers at the end of the 1941 internodes resulting in constriction of the twigs and transverse, irregular cracking of the cortex. This is believed to be the first record of *G. cingulata* on *R.*, which is, however, subject to infection in Maryland, as well as in Europe, by *Gloeosporium rhododendri* Briosi & Cav., with characters indistinguishable from those of the imperfect stage of *Glomerella cingulata.*

Sprague (R.). **Root rots of Gramineae in the Northern Great Plains, 1940–43.**—*Plant Dis. Reptr,* xxvii, 12–13, pp. 248–250, 1943. [Mimeographed.]

The results of inoculation experiments during the winter of 1942–3 showed that *Pythium arrhenomanes* is the most important parasite of grasses in the Northern Great Plains [*R.A.M.*, xxiii, p. 263], but other fungi implicated in pre-emergence killing include *Helminthosporium sativum, P. debaryanum, P. ultimum, P. irregulare,* and *Fusarium scirpi* var. *acuminatum,* of which the *P.* spp. are also responsible for root necrosis and stunting in sorghums, millets, and some small-seeded grasses. The use of 20 'indicator' hosts for inoculations with *P. debaryanum* showed that the rotation problem is considerably complicated by the varying pathogenicity to different crops of the several isolates, those from Gramineae, for instance, destroying many of the non-grass 'tester' hosts and vice versa. To cite one example, old orchard soil clean-cultivated for 25 years at Mandan, North Dakota, contained sufficient inoculum of the fungus to reduce the emergence of Turkestan lucerne, Turghai proso millet [*Panicum miliaceum*], Rival wheat, and Standard crested wheatgrass [*Agropyron cristatum*] by 50, 55, roughly 0, and 16 per cent.,

respectively. Some of the 'indicators', e.g., *Bromus arvensis* and *B. tectorum*, proved highly resistant to *Pythium arrhenomanes* but susceptible to certain isolates of *P. debaryanum* at the time of seed germination. *P. arrhenomanes* shows little tendency to physiologic specialization in the region under observation, but one aberrant form isolated from irrigated barley in South Dakota was highly pathogenic to the normally resistant *A. intermedium*, in which it caused 98 per cent. loss, the corresponding figures for wheat and *A. cristatum* being 61 and 100 per cent., respectively. The ordinary isolates of the same fungus caused the following stand reductions in greenhouse trials from October to February: *A. cristatum* 60 to 100 per cent., *Panicum miliaceum* 95 to 100, blue grama [*Bouteloua oligostachya*] 100, Victory oats 4 to 20, wheat 8 to 30, *Bromus tectorum* 20 to 30, *B. inermis* 30 to 90, *Elymus canadensis* 30 to 60, Black Amber sorghum 45 to 65, and *A. intermedium* 40.

Pythium tardicrescens [ibid., xix, p. 696] was isolated in 1942 from oats in Washington and *Echinochloa crus-galli* in Minnesota, this being apparently the first report of its occurrence south of the Canadian prairies. The reaction of the 'indicators' to the organism was generally similar to that induced by *P. arrhenomanes*.

Attempts at the control of *P.* spp. by various soil amendments gave disappointing results, but seed treatment with semesan and spergon proved beneficial against root rot of *Panicum miliaceum* and *Bouteloua oligostachya*. At Mandan, Russian wild rye (*E. junceus*), *A. cristatum*, *Bromus inermis*, and other cool-temperature grasses largely escape seedling blight if sown in the autumn.

Nilsson-Leissner (G.). **On the possibilities of breeding new strains of Timothy by means of selfing.**—Abs. in *Hereditas*, xxviii, 3–4, pp. 500–502, 1942. [Received September, 1944.]

The experiments on selfing in timothy [*Phleum pratense*] as a means of improving various characters, including resistance to rust [*Puccinia phlei-pratensis*], the principal disease of the crop in Sweden, were planned and largely carried out by N. Sylvén at the Herbage Plant Department, Swedish Seed Association, Svalöf, and a detailed report of the work was prepared by G. Julén for *Sverig. Utsädesfören. Tidskr.*, 1942. In 1939, when the disease assumed a very severe form, enhanced susceptibility was general among the inbred plants, the differences being particularly obvious between the P and I_1 generations. Certain strains, however, showed a high degree of resistance throughout the investigations (which were initiated in 1926), and it is therefore concluded that the increased susceptibility to infection caused by inbreeding could be obviated by selection.

Laubert (R.). **Lagerfäulen des Obstes.** [Fruit storage rots.]—*Kranke Pflanze*, xxi, 1–2, pp. 2–4, 1944.

Popular notes are given on the fruit storage rots caused by *Monilia* [*Sclerotinia*] *fructigena*, *Botrytis cinerea*, and *Penicillium glaucum*, all of which are stated to be important and widespread in Germany. Preventive measures should include the thorough cleansing of storage rooms by whitewashing the walls, washing the stands, cribs, &c., with soda water or formalin solution, and fumigating with sulphur; exclusion from storage of any bruised or otherwise damaged or diseased fruits; and the maintenance of a temperature between 3° and 6° C. and of moderate atmospheric humidity.

Mills (W. D.). **Fruit diseases in 1943.**—*Proc. N.Y. St. hort. Soc., 1944*, pp. 18–26, 1944.

Notes are given on the prevalence and severity of fruit diseases in New York during 1943, and on the effects of the different routine treatments applied.

Spraying schedules for 1944.—*Proc. N.Y. St. hort. Soc., 1944*, pp. 299–321, 1944.

Spraying schedules for use in New York in 1944 are given against pests and diseases of apples, pears, cherries, peaches, and grapes.

Brown (D. S.). **Notes and observations from a study of water core in Illinois apples during the 1942 season.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 267–269, 1943.

A study of apple water core [*R.A.M.*, xviii, p. 687; xix, p. 353] indicated that the name is something of a misnomer. In most varieties examined the affected tissues were largely confined to the cortex, Winesap and Stayman Winesap being the only ones in which they were mainly in the core. Also, other materials than water appeared to be involved. Incidence was always associated with vascular tissues. In most varieties, water-cored areas first appeared round the toral bundles or the traces that diverge from them into the flesh. In Winesap and Stayman Winesap, the ventral carpellary bundles were involved, particularly in the region near the stem where the toral bundles and the carpellary bundles emerge. The amount of starch in the affected areas appeared in all cases to be at least equal to that in the unaffected tissues. Water core was noted in some apples long before there was any sign of a decrease in starch anywhere in the cortex. As the fruit matured, the regions round the vascular supply to the cortex were among the last to be freed from starch, and these were the same areas in which water core first appeared.

In general, the number or proportion of affected apples increased as the fruit became more mature. Fruit exposed to sunlight was, on the whole, more affected than shaded fruits. Affected apples were higher in percentage of dry matter than unaffected apples picked at the same time. The juice from affected fruits was usually higher in soluble solids and lower in titratable acid than juice from unaffected apples. On a basis of individual apples, the water-cored tissues were not consistently higher, were, indeed, often lower in soluble solids than the unaffected tissues of the same apple, which also indicates that the starch to sugar conversion is not important in relation to incidence of water core.

Other observations suggested that the source of the trouble is not in the apple itself. Many affected fruits showed guttation through the lenticels. It seems likely that something happens in the tree, in the spur or cluster base, that causes an influx of water and solutes into the apple under pressure, with a resultant filling of the intercellular spaces of the cortex or core, characteristic of water core.

Southwick (L.). **Magnesium deficiency in Massachusetts Apple orchards.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 85–94, 4 figs., 1943.

Foliage scorch due to magnesium deficiency has become serious in certain apple orchards in Massachusetts [cf. *R.A.M.*, xx, p. 559; xxii, p. 437]. Other symptoms noted included yellow banding and mottling of leaves, sudden, premature dropping of older affected leaves, and pre-harvest shedding of fruit. The symptoms, however, differed widely with the varieties; in two greenhouse-grown Malling stocks, one showed characteristic leaf edge burn and the other interveinal scorch.

Chemical analysis of unburned leaves revealed a consistent correlation between symptom severity and the magnesium and potassium content. There was strong evidence to suggest that potassium fertilization leads to increased prevalence and severity of magnesium deficiency symptoms. Data from four varieties indicated that, on a basis of dry matter, a magnesium content of 0·25 per cent. is near the critical level in apple foliage. This amount failed to prevent deficiency symptoms when the potassium level was very high. The soils concerned were quite acid, and contained very small amounts of exchangeable magnesium, analyses of surface soil showing only 6·3 parts of exchangeable magnesium per million parts of dry soil. Chemical analysis of apple leaves would appear to offer an accurate, direct

method of determining the magnesium status of apple trees. Where severe deficiency symptoms prevail, a magnesium fertilization programme should be adopted and the use of potassium discontinued for a time.

BOYNTON (D.), CAIN (J. C.), & VAN GELUWE (J.). **Incipient magnesium deficiency in some New York Apple orchards.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 95–100, 1 fig., 1943.

Several New York apple orchards show a condition apparently due to magnesium deficiency. In July or later, a fading occurs between the veins of the older leaves on some shoots or spurs. The faded areas in McIntosh and Cortland trees often turn pale yellow, but loss of green colour does not proceed so far in Baldwin and Northern Spy leaves before the faded zones die. In all these varieties, necrosis follows the fading and produces typical brown blotches between the veins. When the fading is near the margin, several blotches may overlap, producing marginal scorch. The older leaves may shrivel and absciss by early September, leaving the branch bare except for a few leaves close to the terminals of the shoots. Heavy pre-harvest drop of the fruit ensues, the fruit failing to mature normally. In one orchard, however, the trouble has persisted for over 15 years with no apparent adverse effect on blooming or vegetative growth.

Injections of Epsom salts [magnesium sulphate] appeared to arrest the development of the symptoms, but small overdoses caused severe injury to the current season's leaves, and moderate doses appeared to have only a temporary effect. When moderately affected 18-year-old Cortland trees were sprayed with 2 per cent. Epsom salt solution four times at intervals of two weeks, starting in mid-June, leaf blotch appeared on 10 per cent. of the sprayed trees and 95 per cent. of the controls. The disorder was also controlled by soil applications (at various rates) of magnesium sulphate.

HAMILTON (J. M.) & PALMITER (D. H.). **Apple scab, Cedar-Apple and Quince rust, fruit russet, and Cherry leaf-spot in 1943.**—*Proc. N.Y. St. hort. Soc., 1944*, pp. 27–34, 1944.

During 1943, when rain fell almost continuously during the spring, McIntosh apple orchards in the Hudson Valley, New York, with a heavy carry-over of scab [*Venturia inaequalis*] from the previous season were sprayed with eight fungicides in a comparative test control. As a result of infection, the unsprayed trees dropped all their fruit before July. Of eight sprays applied, lime-sulphur caused considerable drop, while wettable sulphurs gave commercial control of the disease without injury or reduction in yield. In two orchards all the fruits on the unsprayed trees were infected, whereas lime-sulphur ($1\frac{1}{2}$–100 plus 3 lb. lime) gave 4 and 3 per cent. infection, respectively. Flotation sulphur pastes (4 lb. sulphur per 100 gals.) were nearly as effective as lime-sulphur and were superior to dry wettable sprays with a higher sulphur content. Camden paste 6–100 (2·1 lb. sulphur per 100 gals.) was about as effective as the best dry-wettable 5–100, containing more than twice as much sulphur. Fermate ($1\frac{1}{2}$–100) with 17 and 14 per cent. infection was comparable with the better dry-wettable sulphurs, but its use in the first or second cover sprays or at $\frac{1}{2}$ or $\frac{3}{4}$–100 with self-emulsifying cottonseed oil gave better scab control than a continuous sulphur schedule. When Rome Beauty apples were sprayed against cedar-apple rust [*Gymnosporangium juniperi-virginianae*: *R.A.M.*, xxii, p. 486] and quince rust [*G. clavipes*: ibid., xix, p. 28] at the pink, bloom, calyx, and 10-day stages, micronized 3 and fermate $\frac{1}{2}$–100 gave 99 per cent. control of each disease on the fruit, fermate 1–100 giving 97 and 99 per cent. control, respectively, as against 100 per cent. fruit infection by both diseases in the unsprayed controls. When Cortland apples were sprayed against scab and quince rust with micronized 3 and fermate $\frac{1}{2}$, 1 and 7 per cent. fruit infection (scab and

rust, respectively) resulted, as against 100 and 20 per cent. for the unsprayed controls.

Comparative spraying tests against cherry leaf spot [*Coccomyces hiemalis*: ibid., xxii, p. 289] were made on a block of Montmorency trees with a heavy carry-over of inoculum. The cluster and two to three basal terminal leaves had moderate infection before spraying started. Four applications were made before harvest, beginning with the shuck, and one after picking. On 20th October no leaves remained on the terminals of the controls, as against 82 per cent. for microgel $1\frac{1}{2}$ + lime 3–100, and 81 per cent. each for cupro K3 + lime 3 + orthex 1 pint, COCS [copper oxychloride sulphate] $1\frac{1}{2}$ + lime 3–100 + orthex 1 pint, and Bordow 4 + lime 3–100. Fermate $1\frac{1}{2}$–100 with or without lime was as effective as Bordow in the pre-harvest sprays but should not be applied afterwards.

Marshall (R. P.). **Control of Cedar-Apple rust on Red Cedar.**—*Trans. Conn. Acad. Sci.*, xxxiv, pp. 85–118, 5 pl., 2 diags., 1941. [Received September, 1944.]

Of the various materials tested since 1930 for the control of cedar-apple rust (*Gymnosporangium juniperi-virginianae*) on red cedars at Stamford, Connecticut, Keitt and Palmiter's Bordeaux No. 180, which has a high copper-lime ratio (12 : 8) and contains zinc arsenite (8 lb. per 100 gals.) [*R.A.M.*, xvii, p. 118], gave the best results. In 1938, when three treatments were given, the first on 14th April, the second on 27th July, and the third on 10th August, the degree of control obtained was estimated at 98 per cent., the corresponding figures for 1939 and 1940 being 90 and 80 per cent., respectively; in the two latter years the spray was applied only once (on 13th April or 3rd May in 1939 and on 17th May in 1940). The average dosage per tree was 4 gals. in 1939 and 2 in 1940. Not only did the treatment prevent the production of new galls by the rust, but it inhibited sporidial formation by those already present.

Weber (A. L.) & McLean (H. C.). **Spray coverage of Apple trees as affected by different methods of application.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 285–288, 1943.

Studies made to determine coverage (by analysis of leaf samples) on apple trees sprayed by different types of equipment showed that the speed sprayer, in which the spray material as it comes from the nozzles is forced into the tree by a current of air from a propeller, is highly efficient if used properly, and greatly reduces labour. With this apparatus, one grower with three men sprayed his orchard in four days, using one sprayer, although the year before, using the conventional type of sprayer, he had needed seven men and two spray rigs to complete the work in six days in the absence of adverse winds. With the speed sprayer such winds did not prevent efficient coverage. Other growers reported similar experiences.

Wilkinson (E. H.). **Bitter rot of Apples caused by Gloeosporium album Osterw., with special reference to the variety Allington Pippin.**—*Rep. agric. hort. Res. Sta. Bristol, 1943*, pp. 81–89, 2 figs., [1944].

A study of the lenticel rotting of apples of many commercial varieties grown in Somerset, Kent, Cambridgeshire, Worcestershire, Herefordshire, and Cheshire and kept in cold storage at Long Ashton was made during 1937–9. Four fungi were found responsible, viz., *Cylindrocarpon mali*, *Gloeosporium fructigenum*, *G.* [*Neofabraea*] *perennans*, and *G. album* [*R.A.M.*, xxiii, p. 66]. The first three occurred only occasionally, whereas *G. album* [ibid., xx, p. 475; xxii, p. 363] was isolated consistently, and proved to be the major cause of lenticel rots.

On apple fruits *G. album* (causing bitter rot) usually appears in storage during

the latter part of November, but it has been found to attack Allington Pippin apples on the tree in mid-October. Its development is essentially the same on all varieties. The first symptom is a pale brown or purple marking of the lenticular tissues and the immediately adjacent skin. At the close of the first stage of radial expansion the lesions are uniformly brown, 3 to 5 mm. in diameter, and each has a lenticel at its focus. Radial development progresses slowly until lesions 8 to 50 mm. in diameter are formed, size depending on the number of separate infections on each fruit. The lesions are circular, flattened or concave, and skin-smooth; the margins are sharply defined, and each has a light brown centre surrounded by a darker brown marginal zone. Occasionally lesions are seen with two sets of light and dark brown bands or with a uniform colour and no zonation. Sporing bodies arise subepidermally, raising the skin into small pimples. They burst through the skin and appear as small, white, wax-like bodies which, in mature rots, are arranged concentrically round the central lenticel, and release white masses of spores in a mucilaginous matrix. Bitter rot caused by *G. album* can be distinguished from lenticel rots due to *N. perennans* only by spore examination. The number of bitter-rot lesions on a single fruit ranges from one on such varieties as Bramley's Seedling to over 200 on terminal fruits of Allington Pippin.

In the orchard the fungus is present on small dead twigs and pruning snags. The author has not observed it to form small cankers. The only certain method of detecting its presence is to incubate suspected snags in moist conditions and observe the exudation of glutinous, white spore masses over the surfaces.

During 1937–8 the author examined 21,600 apples of all the popular commercial varieties, and found that 15·41 per cent. of the fruits were affected; in 1938–9, of 12,822 apples examined, 8·16 per cent. were infected. The identity of *G. album* was established in each case. Counts in 1937–8 suggested that degree of incidence depends on the variety, Worcester Pearmain, Cox's Orange Pippin, Laxton's Superb, Grenadier, Bramley's Seedling, and Newton Wonder showing, respectively, 46, 38, 8, 15, 3, and 2 per cent. infection.

Inoculation experiments showed that *G. album* is non-parasitic to living apple twigs, but the fungus can form mycelial cushions on dead twigs beneath the bark, suggesting a rudimentary type of acervulus. Isolates from both apple fruit and infected twigs when inoculated into apple fruits proved the fungus to be an active agent of decay. When mycelium was applied to apple scab (*Venturia inaequalis*) lesions, marginal rots resulted, showing that the fungus can also penetrate the skin in this way. No rots developed, however, when scab lesions were treated with spore suspensions.

Numerical data from 34,000 apples in cold storage at Long Ashton in 1937–9 showed that *G. album* was the most important rot-producing fungus present in that period. Only minor losses resulted from its entry through skin injuries and scab lesions, its main method of attack being through the lenticels. When individual healthy lenticels, or those previously treated with strong ammonia vapour, were inoculated with spore suspensions in the laboratory, no infection resulted after eight weeks. Under natural storage conditions, however, *G. album* does penetrate the lenticels, so that certain changes in these structures must take place to permit entry. Isolations from lesions of all sizes on Allington Pippin apples showed that 37·3 per cent. of those with diameters up to 3 mm. yielded no fungi, whereas lesions with diameters over 3 mm. all gave mycelial growth, with *G. album* present to the extent of 78·7 per cent. Probably, therefore, in this variety the initial stage of many of the lenticel rots is non-parasitic, and the fungi which eventually cause the true lenticel rots, especially *G. album*, are able to penetrate the tissues only because the lenticels have been affected by some form of physiological breakdown, the causes of which are as yet unknown. Climatic factors may, it is thought, play some part in certain seasons.

MUNDKUR (B. B.). & KHESWALLA (K. F.). **A canker of Apple trees in Mysore.**—*Indian J. agric. Sci.*, xiii, 4, pp. 397–398, 1 pl., 1943.

Young apple trees imported from Australia developed, within a fortnight of their arrival in Mysore, a canker of the twigs due to *Sphaeropsis malorum* [(Berk.)] Berk. (*Physalospora mutila* fide N. E. Stevens) [*R.A.M.*, xv, p. 726]. The pathogen is believed to have been introduced into India with the material in question, and the tentative record by Mitter and Tandon of this species [ibid., ix, p. 392] is considered to have been erroneous. The morphology of the Mysore fungus leaves no doubt as to its identity with *S. malorum* (Berk.) Berk. The coarsely granular, thick-walled pycnospores of the former are hyaline and measure 14·4 to 23·4 by 10·8 to 14·4 μ while still enclosed in the pycnidium, after extrusion from which they turn tan or brown, develop a single septum, and measure 16·2 to 23 by 9 to 12·6 μ, being thus slightly shorter and broader than the European strain. A certain resemblance is apparent between this Indian collection of *P. mutila* and *Glutinium macrosporum*, described by Zeller as the agent of an apple and pear canker in Oregon [ibid., vi, p. 735].

While the above note was in the press, a statement by E. W. Mason *in litt.* that the Mysore spores are consistently smaller than those of the European species, *S. malorum* (Berk.) Berk., and therefore do not belong to this species, made advisable a further comparison with Australian material already referred to that species. This was furnished by Dr. C. J. P. Magee. The dimensions of the extruded spores from the type specimen from Great Britain (*fide* E. W. Mason) are 23 to 28 by 10 to 12 μ and those of the Australian specimens 14·4 to 23·4 by 9·2 to 14·4 μ, the latter thus agreeing very closely with the Indian material. One of the Australian twigs bore perithecia and eight-spored asci, possibly representing the perfect stage of the fungus.

MCCOLLOCH (L. P.). **Sporonema rot of Apples.**—*Phytopathology*, xxxiv, 4, pp. 437–439, 1 fig., 1944.

Sporonema oxycocci, the agent of a cranberry storage rot [*R.A.M.*, xix, p. 25], was observed in 1936 to be causing decay of a York Imperial apple held at 36° F. in the same room as cranberries. In further studies on apple storage rots at the Bureau of Plant Industry Station, Beltsville, Maryland, the same organism was again isolated from diseased fruits and inoculated through wounds into healthy York Imperials with positive results at 31°, 36°, and 50°. At the lowest temperature the rot developed slowly, but in the course of several months of storage the lesions assumed serious proportions. At 50° the decay was darker than at 31°, the underlying tissues being, in fact, quite black. Mature pycnidia were formed at 36°, but not at 31°; they originate below the peel and become erumpent through it. On Thaxter's agar the colonies attained a maximum diameter in 24 days of 79·5 mm. at 77°.

BRYANT (L. R.) & GARDNER (R.). **Phosphorus deficiency in Pears.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 101–103, 2 figs., 1943.

Pear trees of the Bartlett, Anjou, Kieffer, and other varieties in parts of an orchard east of Clifton, Colorado, developed a serious condition in 1939, characterized by severe burning of the margins and the tip halves of the leaf blades early in the growing season, decrease in leaf size, failure of the fruit to develop properly, very short terminal growth, a scaly appearance of the bark, and a dying-back of the new growth.

Early in the spring of 1942, 30 seriously affected Kieffer trees were given the following treatments put down to the root zones in auger holes 12 in. to nearly 3 ft. deep: sulphur (5, 10, 15 lb. per tree); treble superphosphate (5, 15, 25 lb.); potassium chloride (2, 6, 10 lb.); sulphur 5 lb. plus treble superphosphate 5 lb.;

sulphur 10 lb. plus treble superphosphate 10 lb.; sulphur 15 lb. plus treble superphosphate 25 lb.; treble superphosphate 5 lb. plus potassium chloride 2 lb.; treble superphosphate 15 lb. plus potassium chloride 2, 6, and 10 lb.; treble superphosphate 25 lb. plus potassium chloride 10 lb. When treble superphosphate was used, alone or in the combinations, striking recovery took place. Even the lowest phosphate application gave a definite improvement. Sulphur used alone also produced satisfactory improvement when not less than 10 lb. per tree was applied. The combination of sulphur with treble superphosphate gave good improvement when as little as 5 lb. of each was used, heavier applications giving excellent results. The potassium fertilizers, alone or in combination, gave no apparent benefit.

Soil tests having demonstrated that sulphur was not deficient, it is concluded that the trouble was due to phosphate deficiency and that the benefits from sulphur resulted from a decrease in alkalinity and consequent increase in available phosphorus in the soil.

LUDWIGS. **Steinsucht der Birnen.** [Stony pit of Pears.]—*Kranke Pflanze*, xxi, 1–2, p. 15, 1944.

During the dry, hot summer of 1943 pears in Germany suffered extensively from 'stony pit' [*R.A.M.*, xx, p. 6]. 'Nests' of cells with hard, woody walls, embedded in the flesh, were found in such quantities that they frequently ruptured the skin and were extruded in crumbling masses; the palatibility of the fruit was impaired and its grade lowered. Stunting and malformation are not infrequent accompaniments of the disorder, which may be combated by thinning out the fruits to reduce the demand for water or by plentiful irrigation during the dry spell.

HUNTER (A. W. S.) & DAVIS (M. B.). **Breeding rust resistant Black Currants.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 467–468, 1943.

A search for suitable black currant varieties for use in breeding against white pine blister rust (*Cronartium ribicola*) was begun at Ottawa in 1935. One bush, identified as *Ribes ussuriense*, has never shown any sign of infection. It is of vigorous habit, but the fruit is small and unpalatable. Of the remaining varieties in the plantation, several plants of the Colorado currant, tentatively identified as *R. aureum* and *R. odoratum* were the least susceptible. In 1938 and 1939 crosses were made between all these and the standard varieties Boskoop Giant and Kerry, both derived from *R. nigrum*.

The seedlings from these crosses have never been sprayed. The year 1942 favoured infection, and the susceptible plants were easily recognized. In the black currant inheritance of resistance appears to be dominant to susceptibility. The plant of *R. ussuriense* used appears to be homozygous-resistant. The plant assigned to *R. odoratum* appears to be homozygous-susceptible, and that assigned to *R. aureum* heterozygous-susceptible. Only a few of the seedlings have fruited, but all have shown a marked resemblance in fruit characters to the cultivated parent; one seedling is particularly outstanding. Most of the seedlings are susceptible to powdery mildew (*Sphaerotheca mors-uvae*), though some are only slightly affected. Susceptibility to powdery mildew is not correlated with susceptibility to white pine blister rust.

MEREDITH (C. H.). **The antagonism of soil organisms to Fusarium oxysporum cubense.**—*Phytopathology*, xxxiv, 4, pp. 426–429, 1944.

Of the organisms, mostly Actinomycetes, isolated from 66 soil samples collected in four localities of Jamaica, 122 were found to be antagonistic in Newry soil solution-agar cultures to *Fusarium oxysporum* var. *cubense*, the agent of Panama disease of bananas [*R.A.M.*, xxii, p. 393]. The degree of inhibition exerted by the

soil organisms was variable, 66 retarding the growth of the parasite weakly, 39 moderately, and 17 actively. The inhibitors, moreover, were irregularly distributed in the 66 soil samples, of which ten contained 44·2 per cent. Some of the organisms arresting the development of *F.o.* var. *cubense* in their own soil solution-agar failed to do so on transference to cultures prepared from other samples.

Da Costa (E. W. B.). **Diseases of the Papaw.**—*Qd. agric. J.*, lviii, 5, pp. 282–293, 10 figs., 1944.

The most serious papaw disease in Queensland is die-back [*R.A.M.*, xx, p. 152], which appears to be due to failure of the roots to absorb sufficient water. The condition is distinguishable from other types of injury with similar symptoms by the browning and death of the young crown leaves before any other tissue is much affected, and the presence of a hard, black scab near the tip of the stem. Occurrence is sporadic and most of the losses are sustained in severe outbreaks of a few weeks' duration. These occur simultaneously over large areas and appear to be due to weather conditions. While all parts of south-eastern Queensland are affected, the severity of incidence varies markedly, not only between districts, but also from farm to farm in an affected area. In selecting sites for papaw plantings, badly drained ground should be avoided, as also should sites with a clay subsoil coming close to the surface. The physical condition of the soil should be improved by drainage, liming, and the incorporation of organic matter. Judicious irrigation will also reduce losses. As affected plants sometimes recover and produce healthy branches, the trunk should be cut back as soon as the condition is noticed.

Yellow crinkle [ibid., xviii, p. 502], which appears to be of virus origin, is very widespread in south-eastern Queensland, and in many areas constitutes a limiting factor in the commercial life of a plantation. It develops chiefly in summer, and appears to spread most rapidly in hot, dry weather. It occurs in all papaw-growing areas and on almost every farm.

Trunk rot, a soft wet rot under the almost intact bark, generally just above ground-level, is caused by a number of fungi, including *Ascochyta caricae* and *Pythium* spp. [cf. ibid., xiv, p. 216], which gain entrance at weak points. The best method of control is to improve the general health of the plant by suitable cultural methods. Care should be taken to avoid injuring the base of the trunk. If only a small part of the trunk is affected, the diseased tissue may be cut out and the cut surface painted with Bordeaux paste or Stockholm tar. If the rot occurs in the upper part of the tree, it may be advisable to cut back the trunk to some inches below the affected area.

Root rot is caused by a number of fungi, including *Pythium* spp. and *Fusarium* spp., but is primarily brought about by a poor physical condition of the soil. Control depends largely on soil improvement; sanitation is important, and all affected seedlings should be dug out and burnt, replanting in the same hole being avoided or at least delayed.

Powdery mildew (*Sphaerotheca* sp.) [ibid., xx, p. 152] may be controlled by sulphur treatments at intervals of three or four weeks from late May to October.

Fruit spot, due chiefly to *Gloeosporium* spp., *A. caricae*, and *Phomopsis* spp. [loc. cit.], may be minimized by removing and destroying all rotting fruits and as many dead stalks as possible, planting the trees in sheltered places, and maintaining a vigorous growth in winter. The fruit should be picked as ripe as possible (with due regard to destination), and should be kept in cool, well-ventilated conditions during storage and transport. If necessary, spraying should be effected at intervals of three weeks from early January to late April and at monthly intervals from early August to October, using a home-made cuprous oxide mixture, or a suitable proprietary substitute, at a strength of 0·1 per cent. copper. Bordeaux mixture itself should not be used.

Black spot (*A. caricae*) [ibid., xvii, p. 259] seldom causes serious loss if the trees are kept in vigorous growth. Incidence may be reduced by removing dead leaf stalks and rotting fruit, and thinning out overcrowded fruit. If losses become serious, effective control may be obtained by applying a protective copper fungicide (of type used against fruit spot) at monthly intervals from May to October.

Fruit rot due to *Rhizopus nigricans* [*R. stolonifer*] may be controlled by improved sanitation and careful handling.

MARTEN (E. A.) & LEACH (J. G.). **Some factors influencing the solubility of cuprous oxide in relation to its toxicity as a fungicide.**—*Phytopathology*, xxxiii, 5, pp. 459–470, 1944.

Using *Pythium debaryanum* as a test organism, the authors studied the influence of certain factors on the solubility and toxicity of cuprous oxide. The growth of the fungus in a standard liquid medium was inhibited by the compound at a concentration of 0·3 to 0·5 p.p.m. copper in solution. As much as 0·6 to 0·8 p.p.m. copper was brought into solution by the prolonged action of doubly distilled water, while ordinary laboratory-distilled water dissolved 1 to 2 p.p.m.

The solubility of cuprous oxide is greatly enhanced by glycine and other nitrogenous products of protein decomposition, 2,200 p.p.m., for instance, being liberated by the addition to the medium of 1 per cent. glycine, which, however, raised the threshold of toxicity (the smallest amount of copper required to inhibit the growth of *Pythium*) from 0·3 to 225 p.p.m.

A 1 per cent. suspension of soy-bean flour increased the solubility of cuprous oxide to 125 p.p.m. of copper. The copper thus dissolved inhibited the growth of *P. debaryanum* when diluted to 0·6 p.p.m., but the admixture with the diluted solution of 0·1 per cent. soy-bean flour increased the threshold of toxicity to between 2 and 3 p.p.m. while 1 per cent. of the flour deprived the compound of its fungicidal properties altogether.

It is thought probable that the presence in arable soils of nitrogenous products of bacterial decomposition may influence the solubility of cuprous oxide used as a seed protectant and thus account for some of the variability in the results of treatment with this compound. It is apparent from the outcome of these trials that the evaluation of protein-containing supplements demands caution, since an excess of such substances may decrease fungicidal efficacy, while smaller amounts, by increasing solubility, may simultaneously raise the fungicidal value of copper compounds.

MARSH (R. W.). **The use of copper sebacate as a foliage spray.**—*Rep. agric. hort. Res. Sta. Bristol, 1943*, pp. 77–80, [1944].

In tests in 1943 it was found that copper sebacate [*R.A.M.*, xxiii, p. 47], mixed dry with agral II or sulphite lye powder and subsequently added to water, readily dispersed to a finely divided suspension of satisfactory stability. The proportion of sebacate to wetter had to be such that on dilution the copper content of the spray, the stability of the suspension, and the wetting power should all be adequate for the spray treatment required. These conditions were met by a mixture of 4 lb. copper sebacate with 2 lb. agral II in 100 gals. water (i.e., 0·1 per cent. Cu, 0·2 per cent. agral II, by weight). This spray was ascertained to be inferior in tenacity to a Bordeaux-agral spray consisting of Bordeaux mixture 8–12–100 to which agral II was added at the rate of 2 lb. per 100 gals., when applied to onion plants, but it was at least as effective as the latter against black currant leaf spot [*Pseudopeziza ribis*] (mean percentage of leaves retained 54±5, as against 45±5 for Bordeaux mixture and 11±2 for the unsprayed control, the difference between the two sprays not being significant).

Salvin (S. B.). **Influence of zinc oxide on paint molds.**—*Industr. Engng Chem.*, xxxvi, 4, pp. 336–340, 1 fig., 4 graphs, 1944.

Spores of paint moulds, including *Aspergillus niger*, *A. flavus*, *Cladosporium herbarum*, and species of *Phoma*, *Penicillium*, and *Dematium*, were sown on a number of paint vehicle constituents, of which raw linseed oil afforded the most luxuriant growth at 25° C. For studies on the influence of nine types of zinc oxide [*R.A.M.*, xxiii, p. 183] on fungal germination, two moulds were chosen with large, black spores and pale germ-tubes to facilitate microscopic observations, viz., *Macrosporium* [*Stemphylium*] *sarciniforme* and *Stachybotrys lobulata*. The inhibition of growth was found to be a direct function of the surface area of the chemical, a fine-particle-size zinc oxide being particularly effective; spore germination in cultures of the two organisms to which the compound was added at a dosage of 0·1 per cent. amounted to 21·7 and 14·4 per cent., respectively, compared with 98·7 and 98·9 per cent., respectively, in the controls. However, zinc oxide, although able to prevent mycelial growth or spore germination, is incapable, as shown by tests on *C. herbarum*, of actually destroying the spores, which were still viable on transference to Czapek-Dox nutrient agar after three weeks' exposure to the chemical. Zinc oxide, therefore, should properly be termed 'fungistatic' rather than 'fungicidal'. Respiration studies on *A. niger* indicated that the zinc ion affects the carbohydrate metabolism of the fungus, and it is this property, no doubt, that is basically responsible for the observed fungistatic action of zinc oxide.

Barker (H. D.), Greathouse (G. A.), & Marsh (P. B.). **The problem of standardizing test methods for mildew and rot resistant treatments of textiles.**—*A.S.T.M. Bull.* 126, pp. 32–34, 1944.

Some of the problems connected with the highly complex operations involved in the testing of fungicides for the prevention of textile rots and mildews are briefly discussed and the following conclusions reached. Evaluation tests should determine (1) whether the protective agent possesses fungicidal or fungistatic properties; (2) the degree of its resistance to leaching, photochemical action, ionic adsorption, and other weathering agencies, the prolonged action of which tends to reduce the concentration on the fabric to a value permitting the growth of deleterious micro-organisms; and (3) the amount of the antiseptic required to assure practical service life for the treated materials. In contrast to the detailed investigations necessitated by these sensitive procedures, acceptance tests should be based on rapid routine methods, capable of detecting 'spotty' application or confirming the correctness of the treatments given.

One possibility felt by the writers to have been insufficiently explored is the substitution of simple quantitative chemical for biological tests as acceptance procedures.

Eastwood (T. M.). **Bacteriostatic and fungistatic action of some organic chemicals.** —*Science*, N.S., c, 2584, pp. 10–11, 1944.

Observations made in 1940 indicated that various bacteriostatic and fungistatic organic chemicals offer a means of separating bacteria and fungi in pathological organism isolation work. Anisic acid (150 p.p.m.), benzoic acid (150 p.p.m.), and, possibly, chrysoidine Y (60 p.p.m.) selectively inhibited bacterial growth. Chlorothymol (60 p.p.m.) and hexylresorcinol (60 p.p.m.) selectively inhibited fungal growth. Sodium 2-, 4-, 5-trichlorophenate (10 p.p.m.), 8-hydroxyquinoline sulphate (10 p.p.m.), and sodium ortho-phenylphenate [tebecit] (60 p.p.m.) produced variable fungistatic action.

Baker (Gladys E.). **Heterokaryosis in Penicillium notatum.**—*J. Bact.*, xlvii, 6, p. 581, 1944.

Heterocaryosis is established in *Penicillium notatum* shortly after spore germination through anastomoses, or it may already be in existence at this stage if, as occasionally happens, the germinating conidium is binucleate. Germination is effected by means of one or two germ-tubes, and a single conidium may give rise to a homo- or heterotypic colony, according to its original uni- or binucleate character. Mass spore transfers result, in 12 to 24 hours, in numerous anastomoses, which assure a free intermingling of cytoplasm and nuclei, thereby introducing different genetic combinations into the colony and making it heterotypic.

The maintenance of an active penicillin-producing strain of the mould [*R.A.M.*, xxiii, p. 141] is a long-standing problem, since monospore transfers afford no guarantee of constancy. If activity depends on heterocaryosis, mass spore transfers would appear to provide the best means of achieving this condition, since the likelihood of isolating a single binucleate, heterotypic spore is remote.

Steinberg (R. A.). **Variants in fungi: formation, reversion and prevention.**—*Science*, N.S., c, 2584, p. 10, 1944.

Variant strains of *Aspergillus niger* obtained by chemical induction [*R.A.M.*, xxi, p. 468] were found to revert to normal when grown on high concentrations of amino acids, particularly lysin. Loss in ability to differentiate was attributed to upsets in the characteristic basal complement of enzymes employed in the utilization of amino acids in the normal strain. *A. niger* has been maintained in stable condition for 27 years under laboratory conditions. It is suggested that the use of amino acids may assist in the recovery of the normal strain of *Penicillium notatum* after variant formation, though in some instances the reversion form is not identical with the initial strain. It is possible that a cycle of variant formation and reversion might, for this reason, lead to better penicillin-producers. Autolysed cultures of *A. niger* produce variants that seem to be eliminated by culturing at optimum temperature and frequent transfers.

Sharp (L. W.). **Fundamentals of cytology.**—x+270 pp., 125 figs., 51 diags., New York & London, McGraw-Hill Book Company, Inc., 1943. $3.00.

This text-book, intended for use in connexion with college and university courses in the biological sciences, contains numerous references of interest to mycologists and plant pathologists, including sections on the cytology of reproduction in the fungi, the structural components of protoplasts (among them the intracellular bodies characteristic of certain plant viruses), chromosomal aberrations, and so forth. A list of works proposed for reading in conjunction with each chapter is appended.

Yarwood (C. E.) & Hazen (W. E.). **The relative humidity at leaf surfaces.**—*Amer. J. Bot.*, xxxi, 3, pp. 129–135, 1 fig., 4 graphs, 1944.

On the basis of a study of the relative humidity at leaf surfaces [determined by a method which is described in detail], the authors formed the opinion that the humidity at leaf surfaces more nearly approaches that of the surrounding atmosphere than that of the intercellular spaces, contrary to the view commonly held that it more nearly approaches that of the latter than that of the former. The authors believe that data such as published by Karla Longrée [*R.A.M.*, xviii, p. 681], who reported that spores of *Sphaerotheca pannosa* var. *rosae* germinated better on leaf surfaces than on glass slides in the same environment, are more likely explained by host stimulation of the germination of powdery mildew conidia as observed by Yarwood in 1936 [ibid., xvi, p. 104] than on the basis of the supposed high humidity at leaf surface.

MAGROU (J.), DOUCHEZ (Mlle Y.), & SEGRETAIN (G.). **Symbiose de la Pomme de terre avec les endophytes de diverses plantes.** [Symbiosis of the Potato with the endophytes of various plants.]—*Ann. Inst. Pasteur*, lxix, 7–8, pp. 246–247, 1943.

Experiments were conducted to determine the conditions under which symbiosis between the cultivated potato and the endotrophic mycorrhizal fungi of other plants could be effected, thereby simulating the ancestral environment of the potato [*R.A.M.*, xviii, p. 341]. There are two types of endotrophic mycorrhiza, one represented by *Arum maculatum* [ibid., xv, p. 243] and the other by *Paris quadrifolia*; in the former the main stems of the mycelium are intercellular and extrude into the cells branches which develop into arbuscules, whereas in the latter the entire fungus is strictly intracellular. Besides *A. maculatum*, the following plants of the same mycorrhizal type were chosen for the tests: *Bellis perennis*, *Orobus tuberosus*, and *Mercurialis perennis*, while *Ficaria ranunculoides*, *Viola horta*, and *Solanum dulcamara*, as well as *P. quadrifolia* itself, represented the intracellular form. The potatoes were raised from seed in the various mycorrhizal soils, either in pots for laboratory studies or *in situ* in the Paris and Poitiers regions.

In all cases the potatoes developed a profusion of mycorrhiza either of the *A. maculatum* or *P. quadrifolia* type, according to the particular plant with which they were in contact. Of special interest is the case of *B. perennis*, the characteristic fasciculate grouping of the straight intercellular hyphae of its endophyte being exactly reproduced in the potato mycorrhiza. It is also worthy of mention that the endophyte of a monocotyledonous plant, such as *A. maculatum*, can invade the dicotyledonous potato. The symbiotic potato plants produced 'primary' tubers, which on replanting the following season in the Paris district gave satisfactory yields of 'secondary' tubers for seed. For instance, 65 of the 'primary' tubers of plants sown in 1941 in a meadow containing large numbers of *B. perennis* were replanted in 1942 in manured ground and produced a total yield of 63,750 kg., or an average of 0·980 kg. per plant, corresponding to a harvest of 29·4 tons per ha., which compares favourably with the output of 15 to 18 tons per ha. normally regarded as adequate.

MAGROU (J.), BOUGET (J.), & SEGRETAIN (G.). **Semis symbiotiques de Pomme de terre dans les Pyrénées.** [Symbiotic sowings of Potato in the Pyrenees.]—*C.R. Acad. Sci., Paris*, ccxvi, 16, pp. 501–503, 1943.

In the spring of 1942, potato seed of different varieties was sown under glass at Bagnères-de-Bigorre (Pyrenees) in mountain soil harbouring numerous mycorrhizal plants [see preceding abstract]. The resultant very vigorous plants were transferred between May and July either to manured fields or to the uncultivated, recently cleared ground whence the soil for the experiments was taken. The yield was not remarkable, since many of the plants died from drought, but the size of the tubers (up to 9 by 4·5 cm.) does call for comment, being exceptional for the products of a symbiotic stand. The roots were yellow (a characteristic sign of mycorrhiza in the potato), and moreover, microscopic examination revealed an extensive infestation. The mycorrhiza probably functioned as purveyors of nitrogen, which occurs principally in a form unassimilable by plants in the soils in question.

SAMUEL (G.). **Potato haulm killing.**—*J. Minist. Agric.*, li, 6, pp. 277–279, 1944.

The practice of killing off potato haulms at the end of the season with sulphuric acid or other sprays is now [*R.A.M.*, xvi, p. 55; xvii, p. 131] carried out in England over thousands of acres. It is, however, unnecessary if the haulms begin to die off naturally before the end of September, or if blight [*Phytophthora infestans*] kills off

the haulms by lifting time. It is safe to let blight completely kill the tops if the tubers are well earthed up and the soil does not allow the spores to penetrate to the tubers. On dry soils and those that crack on drying, blight, if present on the tops for long, may infect many tubers in the soil. Under such conditions, the tops should be burnt off as soon as infection becomes prevalent in the crop. The best time to burn off depends partly on the weather; increased infection on the tops is not very dangerous when only light rains are experienced, but a heavy rain may carry the disease into the soil. Growers should have their own spraying machines, so that if a heavy rain threatens in autumn, blighted haulm can quickly be burnt off as a precaution.

Two useful substitutes for sulphuric acid are a mixture of copper sulphate and salt (30 lb. powdered bluestone and 10 lb. salt. per 100 gals. water) and tar distillate washes. The former is not satisfactory on vigorously growing haulm when it has to be killed off by seed growers and it does not destroy the stems as effectively as sulphuric acid, while the tar distillate washes take 10 to 14 days to kill the leaves and cost about three times as much as sulphuric acid. Sodium chlorate and calcium cyanamide were used before the war, but are no longer obtainable. Some firms now make apparatus for atomizing undiluted sulphuric acid, and the saving of water-carting which this permits is important in some areas. It is hoped that there may be further developments in this process, which may prove very valuable in haulm killing.

As haulm destruction checks growth at once, premature treatment may appreciably reduce yield; even in September, crops with green haulm can put on over ½ ton of tubers per acre per week. The method remains, however, a most valuable aid in safeguarding tubers from infection at lifting time, especially in a wet autumn.

PAYETTE (A.) & PERRAULT (C.). **Action de la thiamine sur le Phytophthora infestans (Mont.) de Bary.** [The action of thiamin on *Phytophthora infestans* (Mont.) de Bary.]—*Canad. J. Res.*, Sect. C, xxii, 3, pp. 127–132, 1 pl., 1944. [English summary.]

Phytophthora infestans when grown in culture appeared to require thiamin, maximum effects resulting from 0·2 μgm. in 1 c.c. of the liquid mineral-dextrose medium containing asparagin and organic acids. Unlike *Phycomyces blakesleeanus*, *Phytophthora infestans* failed to respond to the pyrimidin and thiazole derivatives of thiamin. Inositol in combination with thiamin at certain concentrations appeared to inhibit the effect of the thiamin to some extent, whereas a yeast extract, almost ineffective by itself, appeared to increase it.

MCINTOSH (T. P.). **Potato troubles.**—*Gdnrs' Chron.*, Ser. 3, cxvi, 3010, pp. 87–88, 1944.

Experimental evidence is briefly adduced from the Seed Testing and Registration Station, Corstorphine, Edinburgh, to show that potato virus X is transmissible by contact between the sprouts of diseased and healthy tubers in storage.

In a small-scale test to determine the effect of chilling on the incidence of dry rot [*Fusarium caeruleum*], 1 cwt. Catriona tubers was divided into three lots, of which one was kept continuously in a storehouse free from risk of cold, a second was removed from the same place during frosty weather in December for 3½ hours on several days, and a third was similarly treated for seven hours. All were left in the same storehouse until 25th April, when the incidence of dry rot in the three lots was found to amount to 13·5, 23·5, and 35·5 per cent., respectively. In a comparable test with Doon Star tubers, in which, however, the exposures were carried out at a somewhat higher temperature in March, the amounts of dry rot in the chilled and unchilled lots were 10 and 6 per cent., respectively. The reason for the greater susceptibility of the chilled lots is not clear, but the control had least

reducing sugars when tested in January. The growth of plants raised from unchilled tubers was much more rapid and vigorous than that from the chilled, and it would appear from these admittedly scanty data that chilling may be responsible for larger reductions in field and garden crops than is generally suspected.

HARVEY (R. B.), REICHENBERG (A.), LEHNER (BERNICE), & HAMM (P. C.). **Hair sprout of Potatoes.**—*Plant Physiol.*, xix, 2, pp. 186–193, 1944.

'Hair sprout', characterized by the precocious sprouting of potato tubers at 65° F. (the normal storage temperature), notably among the Bliss Triumph and White Rose varieties, is only of sporadic occurrence in Minnesota, but in 1938 it was sufficiently prominent to decrease the value of the affected crops for seed purposes. The hair sprouts are usually less than 2, often only 1 mm. in diameter, and grow rapidly, producing a succession of tubers, 1 to 2 cm. in diameter, either directly appressed to the mother tuber or borne on a stolon up to several cm. or on side branches some inches in length. They continue to grow under favourable conditions, reaching a length of 6 to 8 ft. in darkness, with branching rudimentary leaves, but not increasing appreciably in diameter. In short, hair sprouts resemble stolons rather than stems. Some of the early-sprouting buds produce shoots of a diameter intermediate between normal and hair sprouts, which may be differentiated from the former, however, by the premature formation of shoots. A single tuber may give rise to normal and hair sprouts (intermediate and extreme), the aberrant condition apparently being common to all the buds in one eye. Hair sprouts are positively phototropic, but collapse from stem weakness after a few inches of growth. The small tubers produced by hair-sprout plants in the greenhouse gave rise to normal plants, indicating that the condition is not hereditary. It was further experimentally shown not to be transmissible by grafting hair sprout scions on normal stock and vice versa, and that it cannot be transmitted from the tuber to normal buds or corrected in hair sprout buds by reciprocal grafting.

No substantial difference was detected by analytical methods between normal and hair-sprout Bliss Triumph tubers in respect of total nitrogen, pentosans, and pentoses on the dry-weight basis. There was, however, a consistently higher percentage of reducing and total sugars and a decrease in percentage dry weight of hair-sprout White Rose tubers as compared with normal ones of the same variety. For instance, the percentage dry weights (average) of normal, intermediate, and extreme hair-sprout tubers (seven in each group) were 22·73, 20·55, and 17·19, respectively, the corresponding figures for reducing and total sugars being 2·82, 5·44, and 8·65, and 4·11, 7·14, and 10·60, respectively. Differences of this order were maintained both at high and low storage temperatures. There was no consistent differential trend in the starch percentages of normal and hair-sprout tubers.

MICHENER (H. D.). **An experiment on the physiological nature of spindling sprout.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 511–513, 1943.

An experiment is described which showed that potato spindling sprout [*R.A.M.*, xx, p. 377] stems increase in size when grafted on to normal stems (on the average 0·9 and 0·8 mm. in main and lateral stems, respectively, compared with a decrease of 0·1 and 1·0 mm., respectively, for normal scions on normal stock). The most probable explanation of this is that the spindling sprout stems derive something from the normal stems which they otherwise lack. The spindling sprout tuber may, therefore, lack some substance necessary for normal growth, or it may contain all necessary substances but lack the means to move them to the growing stem.

WATSON (R. D.). **Charcoal rot of Irish Potatoes.**—*Phytopathology*, xxxiv, 4, pp. 433–435, 1 fig., 1944.

This is an expanded account of the writer's studies on charcoal rot of potatoes

(*Sclerotium bataticola*) [*Macrophomina phaseoli*] in eastern Texas, a preliminary note on which has already appeared [*R.A.M.*, xxiii, p. 187]. High temperature (80° to 85° F.) being the chief environmental factor conducing to the pathogenicity of the fungus, early planting and harvesting and cool storage (34° to 38°) are important control measures. The disease is also favoured by abundant humidity, and the crop should therefore be grown only on well-drained sites, while storage in crates will assist in the maintenance of a dry atmosphere and provide air circulation, thereby reducing the incidence of secondary rots.

Diehl (W. W.). **Bibliography and nomenclature of Puccinia oryzae.**—*Phytopathology*, xxxiv, 4, pp. 441–442, 1944.

Puccinia oryzae, apparently a distinct race of *P. graminis*, has hitherto been reported only from limited areas in Spain and Italy, but a recent paper by O[lga] Săvulescu (*Bull. Sect. sci. Acad. roum.*, xxii, 7, pp. 305–308, 1940) points to the existence of the rust also in Rumania. The economic importance of this rice parasite is normally inconsiderable, and little attention has therefore been accorded to it, but its destructive potentialities are such as to justify universal quarantine measures against it. Critical comments are made on the few references to the rust in the scientific literature, and the conclusion is reached that the name *P. oryzae*, for which Briosi omitted to furnish a technical description, is a *nomen nudum*, but as treated by González Fragoso (*Trab. Mus. Cien. nat., Madr.*, Ser. Bot., 15, 1918), it would be valid as *P. graminis* Pers. f. *oryzae* Frag.

Addicott (F. T.). **A note on the effect of splash injury in Guayule seedlings.**—*Phytopathology*, xxxiv, 5, pp. 508–510, 1 fig., 1944.

The overhead method of watering guayule [*Parthenium argentatum*] seedlings in nursery beds tends to produce a condition herein designated 'splash injury', which results in severe losses at the cotyledon stage. The outstanding external symptoms of the trouble are a brown discoloration and apical and marginal shrivelling of the cotyledons. The examination of fixed and stained preparations of affected material from a nursery at Salinas, California, revealed plasmolysis, cytolysis, and final complete collapse of nearly all the parenchyma cells in the cotyledon. There was no evidence of parasitic intervention in the causation of the disturbance, which is attributed to the beating of soil or water on the plant or their accumulation round it.

Langford (M. H.). **Fungicidal control of South American leaf blight of Hevea Rubbertrees.**—*Circ. U.S. Dep. Agric.* 686, 20 pp., 7 figs., 1 diag., 1943.

Under a co-operative arrangement between the United States Department of Agriculture and the Goodyear Rubber Plantations Company, the writer initiated spraying and dusting tests for the control of South American leaf blight (*Dothidella ulei*) of *Hevea* rubber seedlings at All Weather Estate, Panama, in 1940. Shortly after the conclusion of these experiments in July, 1941, further tests with some of the more promising materials were undertaken at the Department's Co-operative Rubber Field Station, Turrialba, Costa Rica, and at the Goodyear Company's Speedway Estate, Cairo, Costa Rica.

The results of the preliminary tests indicated that the disease could be economically combated by weekly spraying either with 'insoluble' copper (basic copper sulphate, copper silicate, copper phosphate, copper oxychloride, and cuprous oxide) or wettable sulphur, with the addition of a spreader, such as casein plus wheat flour. The feasibility of these methods of control was confirmed by the subsequent more extensive trials. Summarizing the data obtained in the initial tests in

Panama and those at Cairo, Costa Rica, it may be stated that some 70 per cent. of the treated seedlings reached budding size within a year, as against only 15 to 20 per cent. of the controls. At Turrialba, where conditions are particularly favourable to the development of *D. ulei*, spraying increased the number of buddable one-year-old seedlings from 0 to over 60 per cent.

The important factor in the success of spraying for the control of leaf blight is the location of the seedling nurseries at a distance of several hundred yards from the nearest rubber trees. At All Weather Estate a nursery of some 1,000 susceptible seedlings was planted beside a badly diseased one-year-old stand, and on the same day another was laid out 500 yards from the nearest infected trees, neither being sprayed. In the former, a high incidence of blight developed as soon as the seedlings emerged from the soil, whereas in the latter the disease did not appear until the plants were several weeks old.

Since the residues of copper sprays have been found to exert a detrimental effect on budwood, it is advisable to substitute wettable sulphur for copper in the later applications. E. T. Stanwood, who experienced this difficulty at the Co-operative Rubber Plant Field Station in Honduras, found that the residue could be largely removed by three seconds' immersion of the budwood in 0·3 per cent. hydrochloric acid, immediately followed by thorough rinsing in running water.

Tests which are still in progress have indicated the practicability of controlling leaf blight by spraying high-yielding, susceptible budded trees until they reach a size suitable for top-budding. Promising results were also obtained by the treatment of 40 five-year-old trees during the annual leaf-change period in March, 1941, when five applications of a copper fungicide at four- to six-day intervals permitted the retention of 90 per cent. of the leaves, whereas the unsprayed controls were repeatedly defoliated and consequently suffered from die-back.

Full directions are given for the location and layout of *Hevea* nurseries and for spraying procedures. The most economical type of equipment depends on the size of the nursery, an inexpensive knapsack sprayer sufficing for 1,000 to 2,000 plants, a barrel pump for rather larger estates, while a power-machine of at least 300 lb. pressure, with a triple-nozzle gun with No. 3 disks, is the most effective apparatus for large-scale use. In general, the 'insoluble' coppers and wettable sulphurs should be applied at dosages of 2 and 6 lb., respectively, per 100 gals.; in the writer's tests, 150 to 250 lb. copper or 600 to 1,000 lb. sulphur has been requisite to bring each acre of susceptible seedlings to budding size. Fermate ($1\frac{1}{2}$ lb. per 100 gals.) gave equally efficient control with the copper fungicides in preliminary tests. The casein plus flour spreader should be used at the rate of $\frac{1}{4} : 2 : 100$, or the former alone at $\frac{1}{2} : 100$. From limited experiments at Turrialba the total cost of protecting field-spaced, high-yielding, susceptible trees until they are ready for top-budding is computed at under $5 an acre.

Balks (R.) & Wehrmann (O.). **Schädigungen der Kulturpflanzen durch Grubengas?** [Damage to cultivated plants from mine gas?]—*Forschungsdienst*, xvii, 3, pp. 133–138, 1944.

The presence of methane in the soils of German mining districts was shown by analytical studies to be responsible for a pathological condition expressed by the poor state of health of the crops grown therein. In some of the samples investigated the methane content of the soil atmosphere was over 90 per cent. Abnormal features of such soils include a musty odour, deterioration in the crumb structure, and a dark grey to blackish-blue discoloration, especially of the predominant brown to reddish arable soils. The gas deprives the soil atmosphere of the oxygen essential both for plant life and the beneficial soil microflora, thereby adversely affecting the oxidation-reduction processes.

Hewitt (E. J.). **Experiments in mineral nutrition. I. The visual symptoms of mineral deficiencies in vegetables and cereals grown in sand cultures. Progress Report No. 1, 1943.**—*Rep. agric. hort. Res. Sta. Bristol, 1943*, pp. 33–47, [1944].

In continuation of the work of T. Wallace on the diagnosis of mineral deficiencies in plants by visual symptoms [*R.A.M.*, xxii, p. 406], cereals and vegetables were grown in sand culture for the systematic study of mineral deficiency symptoms produced under conditions of controlled nutrient supply. The aims of the investigation included the determination of the effects of added sodium sulphate and sodium chloride with special reference to the use of salt as a fertilizer, the study of the problems involved in maintaining large-scale deficiency culture experiments using a wide range of crops, and the development of a technique for the study of trace element deficiencies, using rain water, and distilled water. A tabulated, systematic description is given of typical deficiency symptoms observed on maize, cabbage, cauliflower, marrowstem kale, turnip, lettuce, radish, celery, sugar beet, broad and dwarf beans, red clover, flax, leek, tomato, and potato, the number of days after which they became evident being shown in each case.

It is concluded that the use of unwashed sand is suitable for major-element deficiency cultures and boron and manganese deficiencies in some crops, but not for iron deficiency. Pre-treatment with complete nutrient before sowing is suitable for nitrogen, phosphorus, potash, and magnesium deficiencies in most plants, but not for calcium deficiency, or for potassium and magnesium deficiencies in cereals.

Chowdhury (S.). **Diseases of Pan (Piper betle) in Sylhet, Assam. Part I. The problem and its economic importance. Part II. Phytophthora foot-rot and leaf-rot. Part III. Effect of manuring on the incidence of Phytophthora foot-rot and leaf-rot diseases.**—*Proc. Indian Acad. Sci.*, Sect. B, xix, 5, pp. 147–170, 1 pl., 1 graph, 1 map, 1944.

Pan (*Piper betle*) diseases were first reported in 1929 from the Sylhet district of Assam, where they constitute a serious economic problem. A survey instituted in 1939 under Government auspices to study the extent, etiology, and possibilities of control of the troubles, has yielded the following information. Since 1929–30, the area under *P. betle* in the affected region has decreased from 1,513·8 to 679·8 acres in consequence of the diseases; the number of families engaged in the cultivation of the crop (the hereditary occupation of a special class) has sunk from 4,709 to 3,348; the life of a 'boroj' (a specially constructed house, with sides of grass or straw on a bamboo framework, in which the pan vines are grown) has been shortened on account of pan diseases from 15 to 30 or even up to over 50 years to three or five; while the annual financial loss from the death of the plants is computed at Rs.849,748. The most important diseases are foot and leaf rot (*Phytophthora parasitica*) [*R.A.M.*, vi, p. 579], *Rhizoctonia* root rot, and a sclerotial wilt, of which the first-named is the most widespread and destructive; a foliar disorder due to *Gloeosporium* sp. is prevalent but causes little damage.

The optimum temperature for the development of *P. parasitica* was found to be 28° C. [ibid., xix, p. 258]: five minutes' exposure at 48° kills the pathogen. In the form of dormant mycelium inside planting setts the fungus may be transferred from one place to another, while local spread can be effected by means of drainage water and contaminated soil. The foot and leaf rot are controllable by monthly applications of 2:2:50 Bordeaux mixture at the rate of 1 gal. per ridge 5 ft. in length during the rainy season from May to September. Experiments were carried out to determine the relative efficacy in the prevention of infection of three soil treatments, viz., burning with rice straw, thatching grass, or similar material so as to raise the temperature to between 60° and 70° (the thermal death point of

P. parasitica is 48°); disinfection with 2:2:50 Bordeaux mixture at a dosage of 25 gals. per 100 sq. ft. and kerol (1 in 600, 20 gals. per 100 sq. ft.). The mortality in the three groups of 480 plants receiving these treatments was 5, 8, and 10, respectively, corresponding to percentages of 1·02, 1·66, and 2·08, respectively, while 290 (62·83 per cent.) of the same number of controls were killed by the fungus. After soil sterilization only healthy setts should be planted, and precautions against reinfection through contaminated soil or drainage water are essential.

Different manurial treatments did not materially influence the incidence of foot and leaf rot, which was approximately equal (27 to 28 per cent.) in plots supplied with oil cake, sodium nitrate, or ammonium sulphate, or mixtures of sodium nitrate or ammonium sulphate with superphosphate and potassium sulphate. The average leaf yield, however, was slightly higher in the oil cake-treated plots.

NIRULA (R. L.). **Histopathology of Betel Vine leaves attacked by a bacterium.**—*Sci. & Cult.*, x, l, p. 58, 1944.

Since 1931, when a note on the subject was published in *Proc. Indian Sci. Congr.*, the writer has been engaged on a histopathological study at the College of Science, Nagpur, on a bacterial invasion of cut, stored betel vine [*Piper betle*] leaves. Ingress is usually gained through the cut end of the petiole, though any point on the lamina may occasionally serve as a channel of entry. A water-soaked area develops round the site of attack, to be followed by a brown discoloration and later by blackening along the veins. The phloem tissues become involved at an early stage and are rapidly destroyed, sometimes in the course of a few hours, for a considerable distance along the petiole, midrib, and veins, these effects being apparent to the naked eye in the softening and pulpiness of the dorsal surface of the midrib and some of the veins. The bacterium next reaches the xylem vessels and mesophyll cells, the phloem elements meanwhile having died and undergone disorganization. The same processes occur in the mesophyll cells, whence the pathogen migrates into the intercellular spaces.

RAFAY (S. A.), PADMANABHAN (S. Y.), & KHANNA (K. L.). **Control of Sugarcane seedling disease and nematode injury.**—Abs. in *Proc. Indian Sci. Congr.*, xxix, Sect. xi, p. 218, 1942. [Received May, 1944.]

The examination of the rootlet, collar, and leaf sheath regions of withering and dying sugar-cane seedlings at the Bihar Research Station in April, 1940 and 1941 revealed infection by a species of *Pythium*, which was isolated in pure culture and used in inoculation tests with positive results. Associated with the fungal disease was a foliar discoloration due to nematode injury, this being the first record of the latter organism on sugar-cane seedlings in India. Satisfactory combined control of the fungus and nematode was obtained by one hour's sterilization of the seed-bed soil at 95° C., while the former pathogen was effectively combated by bi-weekly applications to the soil of copper sulphate solution (1 in 10,000) or Cheshunt compound.

MURRILL (W. A.). **Florida Boletes (Boletaceae).**—*Contr. Herb. Univ. Fla*, 6 pp., 1942. [Mimeographed. Received August, 1944.]

The system adopted in this annotated list of Florida Boletaceae [cf. *R.A.M.*, xxiii, p. 410] is based on that proposed by Snell (*Mycologia*, [xxiii, pp. 415–423, 1 fig.], 1941), with the exception of certain alterations necessitated by the International Code. Twelve genera are represented, including a new one, *Frostiella*, a key for assistance in their recognition being provided.

VALLEAU (W. D.), JOHNSON (E. M.), & DIACHUN (S.). **Angular leafspot and wildfire of Tobacco.**—*Bull. Ky agric. Exp. Sta.* 454, 60 pp., 13 figs., 1943.

Studies on tobacco wildfire (*Bacterium* [*Pseudomonas*] *tabacum*) and angular leaf spot (*Bact. angulatum*) [*P. angulata*: *R.A.M.*, xxiii, p. 281] showed that colonies from a pure culture are uniform in type on agar plates, but those produced by different strains differ widely. The colonies range from watery to firm and show various degrees of roughness. Rough cultures have characteristic folded patterns for each colony. Rough and smooth colonies are equally pathogenic. Colony types are somewhat constant in successive transfers and passages through leaves and in storage. Individual leaf spots yield several colony types which, when separated, are fairly constant. The pathogenicity of strains of both organisms ranges from weak to typical spot-producing. *P. tabacum* appears to be a chlorolytic strain of *P. angulata*. No evidence was found that the organisms are identical with *P. fluorescens* [ibid., xxii, p. 80].

Seed is seldom infected with either organism, and seed-borne infection appears to have no part in outbreaks. Evidence was obtained that seed for immediate sowing may be pre-soaked for one hour and then submitted to hot-water treatment at 52° C. for 20 minutes without injury to germination. In dried tissue, the bacteria were generally killed by exposure to 52° for six minutes. The causal organisms appear to be common soil inhabitants living on the surface of the rootlets of various weeds and crop plants [loc. cit.].

Both diseases can be prevented in the plant bed by one or two applications of Bordeaux mixture to the surface of the soil when the plants are small. Plants unaffected at transplanting may contract both diseases after being set out in the field. Both organisms were occasionally isolated from the roots of tobacco plants from Bordeaux-treated beds. Infection can also originate in the field. Injuries by flea-beetles (*Epitrix parvula*) on ground leaves were found to be infected with *P. angulata* in early July. Leaf infection usually takes place through the stomata, but only when the tissues have become so water-soaked that a water channel is formed from the outside of the leaf to the inside, or when bacteria are carried in with water dashed or sprayed against the leaf surface. [Cf. ibid., xxii, p. 114.] Infection may also occur through wounds.

All rapidly-developing tobacco leaves are susceptible to both organisms, but as the leaves mature they become highly resistant. Once the highly susceptible stage is passed, infection takes place less readily through the upper surface than through the lower. In the plant bed the plants are most susceptible when the leaves are 2 to 4 in. long. In field conditions, infection is followed by greater injury to the leaf if the plant is growing in soil deficient in potash.

The condition known as 'blackfire' [ibid., viii, p. 680] and characterized by large, zonate spots on maturing tobacco leaves often appears to be a continuation of an outbreak of wildfire or angular leaf spot or both. It occurs at a time when the leaves do not usually respond to infection by *P. tabacum* and *P. angulata*. It is definitely related to soil fertility. In soil experiment fields it develops later and to a smaller extent on plots deficient in phosphorus (and well supplied with potassium and nitrogen) than on plots to which phosphorus has been added. No treatment on the soil experiment fields has given complete control, but plots to which nitrogen, phosphorus, and potassium were added developed less of the disease than plots not given a complete treatment, while manured plots and those to which ground tobacco stalks had been liberally added developed still less. Some growers have found that heavy applications of a medium-grade mixed fertilizer (sometimes as much as 1,500 lb. per acre) have entirely prevented the development of leaf spot late in the season. Most of the tobacco in areas where blackfire is severe shows signs of potassium starvation. There also seems to be a moisture relation, greatest damage occurring in long periods of damp weather.

CLAYTON (E. E.), GAINES (J. G.), SMITH (T. E.), SHAW (K. J.), & GRAHAM (T. W.). **Control of flue-cured Tobacco root diseases by crop rotation.**—*Fmrs' Bull. U.S. Dep. Agric.* 1952, 12 pp., 9 figs., 1944.

The following diseases constitute a grave problem for growers of flue-cured tobacco in the south-eastern United States: black shank (*Phytophthora parasitica* var. *nicotianae*), bacterial wilt (*Bacterium* [*Xanthomonas*] *solanacearum*), *Fusarium* wilt (*F. oxysporum* var. *nicotianae*), southern stem rot (*Sclerotium rolfsii*), and sore shin (*Rhizoctonia* [*Corticium*] *solani*). Their symptoms are briefly described, a key being furnished to assist in diagnosis, and directions given for their control by crop rotation, based on co-operative experiments in Georgia and North and South Carolina. The relevant information concerning black shank and bacterial wilt has recently been presented [*R.A.M.*, xxiii, pp. 412, 413].

Among the best crops for growing in rotation with tobacco from the standpoint of root disease control are *Crotalaria*, oats, rye, or wheat, and redtop [*Agrostis vulgaris*]; maize, cotton, cowpeas, *Lespedeza*, soy-beans, and velvet beans [*Mucuna deeringiana*], though safe in respect of disease, should be avoided wherever root knot (*Heterodera marioni*) infestation is suspected; potato, tomato, and chilli involve such disease hazards to the succeeding tobacco crop that they should be entirely excluded from the rotation; while sweet potatoes, though resistant to black shank and bacterial wilt, are susceptible to *F. oxysporum* var. *nicotianae* and should never be planted on land to be used for tobacco. The cultivation of tobacco in rotation with stem rot-susceptible crops, e.g., groundnut and soy-beans, has not resulted in any increase in disease. Some of the best alternative crops for disease control, e.g., *Crotalaria* and runner groundnuts result in tobacco of inferior quality, but only when these crops immediately precede tobacco; such unfavourable effects can be eliminated by interposing another crop, e.g., oats.

MELCHERS (G.). **Über einige Mutationen des Tabakmosaikvirus und eine 'Parallelmutation' des Tomatenmosaikvirus.** [On some mutations of the Tobacco mosaic virus and a 'parallel mutation' of the Tomato mosaic virus.]—*Naturwissenschaften*, xxx, 1–3, p. 48, 1 fig., 1942.

A mutant of the tobacco mosaic virus arising spontaneously in the author's experimental material is named *Marmor tabaci* var. *flavum*. It induces on Samsun tobacco leaves primary yellow lesions, followed by secondary developments in the shape of conspicuous vein-clearing, much more pronounced stunting of the whole plant than that caused by ordinary tobacco mosaic, and a yellowish-green mottling of the more or less deformed foliage.

M. t. var. *tenue* was isolated from the juice of plants inoculated with tobacco mosaic and grown at 34° C. On Samsun tobacco there were no primary symptoms, and the secondary spotting was limited to dark green areas along the veins and pale green ones in the interveinal spaces. A strain isolated from a pale lesion on a plant infected by *M. t.* var. *tenue* was named *M. t.* var. *necroticum*. Besides the typical symptoms of *M. t.* var. *tenue*, it induced the formation on the leaves following that primarily infected of small, pale, necrotic spots.

The tomato mosaic virus previously described as 'tomato mosaic virus Dahlem 1940' [*R.A.M.*, xx, p. 236] produces on Samsun tobacco even milder symptoms than those of *M. t.* var. *tenue*. It differs from ordinary tobacco mosaic and the other mutants described in this paper in its capacity to induce on Java tobacco and *Nicotiana sylvestris* primary necrotic symptoms, which do not appear on beans. It is named *M. t.* subsp. *dahlemense*. A mutant arising spontaneously from this virus and named *M. t.* var. *luridum* is characterized by the production on tobacco of primary yellow and secondary yellow-green spots, accompanied by dwarfing of the same order as that caused by *M. t.* var. *flavum*.

TARTAKOWSKY (S.), & ARMANDO GARCIA (A.). **Ensayos preliminares sobre control del damping-off del Tabaco.** [Preliminary experiments on the control of Tobacco damping-off.]—*Bol. Sanid. veg. Chile*, ii, 1, pp. 20–24, 1942.

The most promising results in preliminary tests on the control of tobacco damping-off (*Pythium debaryanum*, *Botryobasidium* [*Corticium*] *solani*, *Peronospora hyoscyami* de Bary (= *P. nicotianae* Will. & Speg.) [*P. tabacina*], *Botrytis cinerea*, etc.), at Santiago, Chile, were obtained by seed treatment with uspulun dust at a dosage of 300 gm. per kg. or with a mixture of the same and mersysol (300 gm.) and by soil disinfection with zinc oxide (300 gm. per sq. m.). By these methods the incidence of infection was reduced from 31 to 19 per cent. Next in order of efficacy (22 per cent. infection) came seed treatment with copper carbonate (300 gm. per kg.) and soil disinfection with 1 per cent. basicop (5 l. per sq. m.).

JONES (J. O.), NICHOLAS (D. J. D.), & WALLACE (T.). **Experiments on the control of magnesium deficiency in greenhouse Tomatoes. Progress report I.**—*Rep. agric. hort. Res. Sta. Bristol, 1943*, pp. 48–53, [1944].

In experiments on the control of magnesium deficiency in greenhouse tomatoes carried out in 1943, marked control followed an application to the soil of magnesium sulphate at rates from 4 to 8 cwt. per acre before planting, with top dressings at 2 cwt. per acre, in the presence and absence of potash in the basal dressings. Treatments at the rate of 4 cwt. per acre in 1942 were unsuccessful. Where potash was used the symptoms were more severe than where it was not employed. Some evidence was obtained that steam sterilization gives partial control. The results suggest that a considerable degree of control can be obtained by the addition of 4 to 8 cwt. per acre magnesium sulphate (calcined kieserite 30 per cent. MgO) to the basal fertilizer dressing.

SMITH (P. G.). **Reaction of Lycopersicon spp. to spotted wilt.**—*Phytopathology*, xxxiv, 5, pp. 504–505, 1944.

The following observations on the reactions of tomato and other *Lycopersicon* spp. to spotted wilt under natural conditions at Salinas, California, are supplementary to D. R. Porter's (unpublished) discovery of a resistant strain of *L. pimpinellifolium* and to Wenholz's report on the resistance of the same species and an unnamed Peruvian type [*R.A.M.*, xix, p. 168]. In 1942, all 104 plants of various strains of tomato and hybrids with Porter's *L. pimpinellifolium*, and all 19 of a single strain of *L. hirsutum* (P.I. 134,417) were diseased, whereas none of the 21 of Porter's *L. pimpinellifolium* or the 48 of five strains of *L. peruvianum* (P.I. 126,930, 126,944, 126,946, 128,659, and 129,146) showed any signs of infection. In 1943, 39 out of 41 plants from known susceptible lots of tomato and hybrids contracted spotted wilt. Of two selections of the German Sugar tomato variety from Hawaii, one was highly resistant (3 out of 10 plants diseased) and the other susceptible. Ten plants each of two lots of Porter's *L. pimpinellifolium* and the *Fusarium*-immune Accession 160 of Bohn and Tucker [ibid., xix, p. 501] were planted, the former remaining immune and six of the latter becoming diseased. Of four lots of 10 plants each of *L. peruvianum* (P.I. 126,928, 126,944, 128,657, and 128,660), one plant of the last-named was probably diseased. The F_1 hybrid of tomato × *L. pimpinellifolium* Accession 160 and five back-crosses of tomato to this hybrid were susceptible, all 69 plants of these hybrids being wilted.

The data obtained in these trials confirm previous observations in regard to the resistance of *L. pimpinellifolium*, while that of *L. peruvianum* was also established. The utilization of the latter is complicated by its reluctance to cross with the cultivated tomato, but this drawback may be overcome by means of a special technique, particulars of which it is intended to publish elsewhere. The susceptibility

of one of the two strains of *L. pimpinellifolium* shows that this species is not uniformly resistant.

VAUGHAN (E. K.). **Bacterial wilt of Tomato caused by Phytomonas solanacearum.**—*Phytopathology*, xxxiv, 4, pp. 443–458, 1 diag., 6 graphs, 1944.

Tomato plants with incipient bacterial wilt (*Phytomonas* [*Xanthomonas*] *solanacearum*) often show no external symptoms of infection until a soil temperature of about 70° F. is reached, though the pathogen may actually become established at 55°. From 70° to 110° the rate of development of the disease increases with the rising temperature. Another essential for the growth of *X. solanacearum* is a constant, but not necessarily plentiful, supply of moisture. The organism is able to overwinter in soils at least as far north as central New Jersey. It does not appear to spread readily through infested soils except when these are moved by cultivating tools or flood water. In potato dextrose agar cultures the optimum hydrogen-ion concentration was P_H 6 to 8, very scanty growth being made below 5 and none at 4.

CROXALL (H. E.). **The control of blight (Phytophthora infestans) on outdoor Tomatoes.**—*Rep. agric. hort. Res. Sta. Bristol, 1943*, pp. 95–99, [1944].

In 1943, plots of six varieties of outdoor tomatoes at Long Ashton were sprayed on 29th July and 2nd September with Bordeaux mixture, proprietary mixtures containing cuprous oxide or copper oxychloride, and a spray containing copper sebacate, all the sprays being made up to contain the same amount of copper as Bordeaux mixture (4–4–100). Approximately 500 gals. per acre were applied on each occasion. The copper sebacate treatment was given only on the earlier date.

Phytophthora infestans appeared in the control plots in the last week of August, and by 1st October, when the final picking was made, all the fruit remaining on the unsprayed plots had become infected. Most of the fruit on the plots sprayed once with copper sebacate was infected, but the other treatments showed only about 2 per cent. infection. The yields of marketable fruits from the sprayed plots expressed as a percentage of those from the unsprayed controls were: Bordeaux mixture 244, copper oxychloride 232, cuprous oxide 227, copper sebacate 147. There were some differences in the effects of the treatments on the yields of different varieties, but Bordeaux mixture, copper oxychloride, and cuprous oxide produced a significant increase in yield with every variety. On all varieties taken together, the average increase in yield obtained by spraying twice with Bordeaux mixture, copper oxychloride, or cuprous oxide amounted to 5½ tons per acre, representing, at 6*d*. per lb., an increase of £310 per acre.

JENKINS (ANNA E.). **A recent account of anthracnose of Poplar in Italy.**—*Rev. argent. Agron.*, xi, 2, pp. 103–105, 1 pl., 1944.

In connexion with recent studies on poplar anthracnose (*Sphaceloma populi*) in South America [*R.A.M.*, xix, p. 366], attention is drawn to Servazzi's record in 1934 of leaf-withering ('seccume delle foglie') [ibid., xiii, p. 605] in Italy, where the pathogen was designated by Saccardo's name of *Hadrotrichum populi* [ibid., xii, p. 661].

PAINTER (J. H.) & DROSDOFF (M.). **Results of preliminary tests on correction of potassium deficiency in Tung.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 65–68, 1943.

In July, 1941, tung oil trees [*Aleurites fordii*] in southern Georgia and adjoining parts of Florida developed a serious disorder associated with a low potassium content in the leaf tissue. The deficiency pattern was of two types; in one, the affected part of the leaf was chlorotic, while in the other, areas in a similar pattern were necrotic. It was assumed that these patterns represented, respectively, early

and advanced stages of one disorder. By August, 1942, recovery had followed a heavy application of muriate of potash or an application of nitrate of potash of 14–0–44 composition given in addition to the basic application of 4 lb. per tree of 3–6–7 mixed fertilizer.

DICKEY (R. D.) & DROSDOFF (M.). **Control of manganese deficiency in a commercial Tung orchard.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 74–78, 1943.

Frenching of tung oil trees (*Aleurites fordii*), reported from Florida in 1937 [*R.A.M.*, xvii, p. 781], has reappeared in the same orchards and developed in other plantings. The prevalence of symptoms varies widely between orchards and between different areas in the same orchard. The symptoms are most pronounced early in the season, and may clear up without treatment as the season progresses.

In August, 1941, affected trees were given 1, 2, or 4 lb. 65 per cent. manganese sulphate per tree together with ½ lb. zinc sulphate. The manganese treatments were repeated in March, 1942, and, in addition, all the trees received 5 lb. of a 5–7–5 fertilizer and ½ lb. zinc sulphate. Frenching was materially reduced, reduction being directly proportional to the amount of manganese applied. The addition of magnesium sulphate failed to increase the effectiveness of the manganese sulphate, but ammonium sulphate (3 lb. per tree), either alone or in combination with manganese sulphate, was beneficial.

It is concluded that, in commercial orchard practice, severe manganese deficiency in mature tung trees in the locality in question can be satisfactorily corrected by a soil application of 2 lb. 65 per cent. manganese sulphate per tree.

DROSDOFF (M.) & DICKEY (R. D.). **Copper deficiency of Tung trees.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 79–84, 2 figs., 1943.

In 1941, an abnormal foliage condition, found to be due to copper deficiency, was noted in a few tung [*Aleurites fordii*] trees in a mature orchard near Morriston, Florida. In 1942, it was observed in several tung orchards in the Gainsville area; a newly planted orchard near Alachua, Florida, and a bearing orchard near Morriston, were also severely affected.

The most characteristic symptom was a 'cupping' of the terminal leaves, which, as a rule, were small and presented an interveinal chlorosis. The cupping and chlorosis were generally accompanied by a tip and marginal burn of the terminal leaves. As severity increased, the necrotic areas rapidly enlarged until the terminal leaves abscissed. The growing point eventually died and some of the affected shoots died back in varying degrees. Shoot growth from axillary buds was stimulated. At this stage, the older leaves showed interveinal chlorosis and ragged, necrotic margins. The symptoms may develop any time during the growing season; in 1941 they were first observed in late summer, whereas in 1942 they were widespread in spring.

Experimental evidence demonstrated that about 5 gm. copper sulphate in 350 ml. water, applied to the soil at the base of an affected one-year-old tree, was sufficient to effect recovery and maintain normal growth from midsummer to the end of the growing season. Complete recovery also followed spraying with copper sulphate solution (1 or 2 per cent.). In commercial practice, where young tung trees show copper deficiency and quick recovery is desired, 1 pint of a solution containing 1 lb. copper sulphate dissolved in 10 gals. water, applied to the soil at the base of the tree, should give satisfactory results. In areas where copper deficiency is prevalent, dry copper sulphate should be applied to the soil in spring, in addition to the zinc sulphate used locally. It is thought that 1 or 2 oz. would probably suffice for trees up to two years old. In mature orchards in copper-deficient soils about ¼ to ½ lb. copper sulphate per tree should be applied.

Birkinshaw (J. H.), Bracken (A.), & Findlay (W. P. K.). **Biochemistry of the wood-rotting fungi. 4. Metabolic products of Trametes suaveolens (Linn.) Fr.**—*Bio-chem. J.*, xxxviii, 2, pp. 131–132, 1944.

The volatile metabolic products of *Trametes suaveolens*, isolated on 5 per cent. aqeous malt agar from a sporophore on a willow [*Salix*] near Oxford, were identified as methyl anisate (the major constituent) and a small amount of anisaldehyde [*R.A.M.*, xix, p. 54]. These two substances are probably the chief contributors to the aroma of the fungus in culture. A little free anisic acid, possibly arising from atmospheric oxidation of the anisaldehyde, was also detected.

Rennerfelt (E.). **Die Entwicklung von Fomes annosus Fr. bei Zusatz von Aneurin und verschiedenen Extrakten.** [The development of *Fomes annosus* Fr. with the addition of aneurin and various extracts.]—*Svensk bot. Tidskr.*, xxxviii, 2, pp. 153–162, 1 graph, 1944.

The development of *Fomes annosus*, a destructive pathogen of Swedish spruce forests, was studied in a synthetic nutrient medium with the addition of various accessory growth substances [*R.A.M.*, xviii, p. 335], of which aneurin, at the rate of $0{\cdot}1\gamma$ per flask of 200 ml. capacity, gave the best results, the dry weight of mycelium after 33 days being $57{\cdot}6 \pm 4{\cdot}5$ mg. compared with $2{\cdot}3 \pm 0{\cdot}5$, $38{\cdot}2 \pm 3{\cdot}2$, $1{\cdot}9 \pm 0{\cdot}2$, and $47{\cdot}5 \pm 3{\cdot}6$ mg. in the cultures containing no extra vitamins, $0{\cdot}05\gamma$ pyrimidin, $0{\cdot}05\gamma$ thiazol, and $0{\cdot}05\gamma$ pyrimidin $+0{\cdot}05$ thiazol, respectively. A highly stimulatory effect was also exerted by yeast extract (0·5 or 1 ml. per flask), yielding dry weights of $55{\cdot}6 \pm 3{\cdot}9$ and $55{\cdot}3 \pm 2{\cdot}8$ mg., respectively, in five weeks, compared with $2{\cdot}8 \pm 1$ mg. in the controls. The growth of the fungus was also promoted to a moderate extent by extracts of humus and compost.

Stillinger (C. R.). **Notes on Cronartium occidentale.**—*Northw. Sci., Wash.*, xviii, 1, pp. 11–16, 1944.

Cronartium occidentale was observed for the first time in nature during the summers of 1919 to 1921 on *Ribes lasianthum*, *R. hesperium*, *R. parishi*, *R. roezli*, *R. speciosum*, *R. cereum*, *R. indecorum*, *R. malvaceum*, *R. nevadense*, and *R. montigenum* in Wyoming. The collections on *R. inerme* in California, *R. aureum* in Montana and Nevada, and *R. odoratum* in Idaho are the first in these States on the host in question, while the presence of the rust in Montana and Nebraska has not previously been reported. The apparent spread of *C. occidentale* from piñon pines (*Pinus edulis* and *P. monophylla*) to *Ribes* for a distance of 650 miles from known foci of infection and 425 miles beyond the ascertained range of the hosts is recorded, these observations having been made at Spokane, Washington, in 1912 and 1914. The rust was shown to be capable of overwintering on living *R.* leaves at Monrovia and Los Angeles, California (1920) and Denver, Colorado (1922). In view of the similarity between *C. occidentale* and *C. ribicola* [*R.A.M.*, xx, p. 187], the agent of white pine blister rust, it is thought not unlikely that the latter may also be conveyed over much longer distances than have hitherto been established for this species.

Buchholtz (W. F.) & Meredith (C. H.). **Pathogenesis of Aphanomyces cochlioides on taproots of the Sugar Beet.**—*Phytopathology*, xxxiv, 5, pp. 485–489, 2 figs., 1944.

This is an expanded account of the writer's observations in Iowa on the sugar beet root rot caused by *Aphanomyces cochlioides*, the salient features of which have already been presented in a summary [*R.A.M.*, xvii, p. 428].

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Rennerfelt (E.). **Undersökningar över toxiciteten emot rötsvampar hos Tallkärnvedens fenoliska bestandsdelar.** [Investigations on the toxicity to rot fungi of the phenolic components of Pine heartwood.]—*Medd. Skogsförsöksanst., Stockh.*, 33, *1942–43*, pp. 331–364, 6 figs., 2 graphs, 1944. [German summary.]

Some of the data obtained in the writer's experiments on the fungicidal properties of pinosylvin and pinosylvin monomethylether, phenolic extractives of pine heartwood, including those relative to *Fomes annosus* [*R.A.M.*, xxiii, p. 464], have already been published [ibid., xxii, p. 282]; in the present paper the remaining information is summarized. *Lentinus squamosus*, *Polyporus marginatus*, and *Polystictus versicolor* succumbed to 0·02 per cent. pinosylvin, and *Coniophora cerebella*, [*C. puteana*], *Corticium laeve* [ibid., ix, p. 78], and *Trametes* [*F.*] *pini* to 0·01 per cent., whereas *Stereum purpureum* and *Polyporus vaporarius* [*Poria vaporaria*] exposed to 0·01 per cent. were still viable on transference to malt agar. At 0·02 per cent. pinosylvin monomethylether was toxic to *Polyporus marginatus* and *Poria vaporaria*, at 0·01 per cent. to *S. purpureum*, and at 0·002 per cent. to *Coniophora puteana*, whereas *Corticium laeve*, *F. annosus*, *L. squamosus*, *Polystictus hirsutus*, *P. versicolor*, *Schizophyllum commune*, and to a lesser degree *F. pini* were more resistant to this compound. Pinosylvin dimethylether was less toxic than either pinosylvin or its monomethylether, which were considerably more toxic than phenol.

The behaviour of *F. pini* in small-scale tests on impregnated pine heartwood blocks was anomalous, its growth under these conditions being practically unimpeded in contrast to its rapid collapse in the presence of the phenolic substances in pure culture.

Zverezomb-Zubovsky (E. V.) & Morochovsky (S. F.). Вредители и болезни Сахарной Свеклы в Башкирии и меры борьбы с ними. [Pests and diseases of Sugar Beet in Bashkiria and measures for their control.]—[*Publ.*] *Inst. bot. Acad. Sci. U.R.S.S.*, 39 pp., 22 figs., 1943.

The symptoms of some well-known diseases affecting sugar beets in Bashkiria, U.S.S.R., are described and recommendations made for their control. They include damping-off, leaf spot (*Cercospora beticola*), the 'propagation fungus' (*Moniliopsis aderholdi*), violet root rot (*Rhizoctonia violacea*) [*Helicobasidium purpureum*], 'tail' rot (*Bacillus betae* [regarded by Miss Elliott as non-pathogenic], *B. lacerans* [= *B. betae* fide Miss Elliott], and other bacteria), three forms of decay due to *Phoma betae*, on the foliage, stems, and seed-clusters, *Fusarium* root rot, downy mildew (*Peronospora schachtii*), mildew (*Erysiphe communis* f. *betae*) [*E. polygoni*], and rust (*Uromyces betae*).

Buchholtz (W. F.). **The sequence of infection of a seedling stand of Sugar Beets by Pythium debaryanum and Aphanomyces cochlioides.**—*Phytopathology*, xxxiv, 5, pp. 490–496, 1 fig., 3 graphs, 1944.

In an experimental study to determine the relative importance of *Pythium*

debaryanum [*R.A.M.*, xviii, p. 5] and *Aphanomyces cochlioides* [ibid., xxiii, p. 464] in the destruction of sugar beet seedling stands in the warm soils of northern Iowa, the former organism killed 33 per cent. of the plants grown from untreated American No. 1 seed in lightly infested soil, 90 per cent. in heavily infested, and 60 per cent. in soil occupied by the two fungi jointly. The seedlings attacked by *P. debaryanum* were nearly all dead a fortnight after planting. Only a small proportion of the seedlings arising from seed treated with new improved ceresan (5 oz. per 100 lb.) was killed by *P. debaryanum*.

Infection by *A. cochlioides* began when the work of *P. debaryanum* had been completed, about 15 days after planting, and by the 28th day nearly all the survivors, from both treated and untreated seed, were invaded by the former pathogen, which, unlike the latter, is not amenable to seed treatment.

Morris (H. E.). **Conditions favouring phosphate deficiency in Sugar Beets.**—Abs. in *Proc. Amer. Soc. Sug. Beet Tech., 1942*, p. 422, 1943.

Phosphate deficiency commonly develops in sugar beets following a two-year lucerne crop in heavy irrigated soils in Montana. Lucerne is a large feeder on phosphates, a four-ton crop of hay removing 40 lb. phosphorus (P_2O_5) without depleting the nitrogen content of the soil. When beets succeed lucerne, the ratio between available phosphorus and nitrogen is unbalanced, with the result that many young plants succumb to black root [*R.A.M.*, xxi, p. 278], while the survivors exhibit acute phosphate deficiency symptoms in July or August. Sugar beet may give a low yield in a poor soil and not develop phosphate deficiency symptoms because the ratio of nitrogen to phosphorus is balanced.

Davies (D. L. G.). **Infection of Pea seedlings with the Fusarium causing foot rot, and some environmental relations of the fungus.**—*Rep. agric. hort. Res. Sta., Bristol, 1943*, pp. 103–107, [1944].

Studies on the organism causing *Fusarium* foot rot of peas (*F. solani* var. *martii* f. 2) [*R.A.M.*, xxi, p. 245; xxii, p. 291] showed that no growth occurred at 0° and 32° C., while the optimum lay between 26° and 28°.

In experiments in a heated greenhouse, pea seeds were sown in pots filled with sterilized soil and inoculum (infected bran) mixed in the proportion of 10 to 1. Emergence was 40 per cent. in the inoculated pots, as against 96 per cent. in the controls. In a second test, one half of each of six boxes was filled with a compost consisting of inoculum and soil in the proportion of 1 to 15, and planted. In the other half, the inoculum was placed in one layer beneath seed-level and separated from the seeds by a layer of soil ¼ in. thick. The results showed that when the inoculum was mixed with the soil, emergence was 72 per cent., when the inoculum was at seed-level, it was 66·6 per cent., and in the uninoculated controls it was 90 per cent. After five weeks, the corresponding figures for surviving plants were 37, 0, and 90 per cent., respectively. Plants growing on the concentrated layer of inoculum showed total decay of the cotyledons and root systems with intense blackening of the region between the point of attachment of the cotyledons and soil-level. Plants in the soil with dispersed inoculum showed a uniform decay of the root systems and foot. When this experiment was repeated, the inoculum being placed in one layer above seed-level and separated from the seeds by a ½-in. layer of soil, the infected pots and the controls showed, respectively, 23·3 and 90 per cent. emergence. All the plants were severely rotted in the region of the epicotyl, which corresponded to the position of the inoculum, and in every instance infection had spread downwards to the cotyledons and roots.

When pea seeds were grown in infected soil in boxes with glass sides it was observed that infection occurred anywhere from the hypocotyl to soil-level. When

a larger proportion of inoculum was used, both radicles and plumules were immediately attacked.

In an experiment conducted out of doors in a wooden box containing inoculated soil, seedling attack was induced under conditions of high temperature.

Greenhouse tests demonstrated that the rate and severity of infection of pea seedlings were directly proportional to the amount of inoculum used. Susceptibility was not affected by soil acidity (P_H 2·75 to 8·75).

MOORE (W. C.). **Chocolate spot of Beans.**—*J. Minist. Agric.*, li, 6, pp. 266–269, 1944.

Chocolate spot (*Botrytis cinerea*) [*R.A.M.*, xxiii, p. 422] is the most serious disease of field and broad beans in England, but its importance has been exaggerated. Records show that during the past 28 years, serious epidemics have occurred over most of the country on five occasions; local epidemics, mostly in the south and west, developed in five other years; in 11 years incidence was normal; and in seven years the disease caused only slight damage.

In 1944, the upper portions of many of the main shoots of beans damaged by May frosts in East Anglia, Yorkshire, and elsewhere were later killed by chocolate spot and soon became covered with the spores of the fungus. The dead tops of these shoots provided a source from which *B. cinerea* could attack the lateral shoots produced lower down the stem to replace the dead main shoot. Winter injury and frost damage give rise to dead or weakened bean material on which a big reservoir of *B. cinerea* accumulates, but rainfall determines the severity of attack. Air temperatures of 60° to 68° F. are most favourable to the fungus, which spreads rapidly only when the weather is wet or very humid. The worst outbreaks occur when late frosts are followed by rains. It is suggested that the fungus may possibly be carried over with the seed.

Experimental evidence has shown that potash deficiency in the soil predisposes beans to attack [loc. cit.], even when the deficiency is not serious enough to produce visible symptoms in the crop. The disease tends to be worse in soils low in available phosphate [loc. cit.]. Spring-sown beans are seldom badly attacked [ibid., xxi, p. 62], while winter beans, sown in September or early October, are sometimes more seriously affected than those sown later. Conditions favouring moisture among the plants also favour the disease.

A soil dressing of $1\frac{1}{2}$ cwt. per acre of muriate of potash or an equivalent amount of potash in another form, such as 6 cwt. kainit per acre, will probably reduce the effects of the disease.

HOYMAN (W. G.). **Witches' broom of Beans.**—*Phytopathology*, xxxiv, 5, pp. 505–506, 1 fig., 1944.

Four bean plants in a Tucson (Arizona) allotment developed an abnormal condition in October, 1943, characterized by excessive multiplication of branches and resulting in typical witches' broom symptoms. The pods on the diseased parts were stunted and frequently wrinkled. One Lima bean [*Phaseolus lunatus*] plant in another allotment in the same town showed similar symptoms in November, the pods being $\frac{11}{16}$ to $1\frac{3}{16}$ in. in length compared with the normal $3\frac{11}{16}$ in., and some two-thirds being wrinkled.

ZAUMEYER (W. J.) & HARTER (L. L.). **A severe necrosis caused by Bean-mosaic virus 4 on Beans.**—*Phytopathology*, xxxiv, 5, pp. 510–511, 1 fig., 1944.

In addition to the two types of infection, local and systemic, already described as characteristic of bean mosaic virus 4 (*Marmor laesiofaciens*) [*R.A.M.*, xxiii, p. 204], a third form of reaction has recently been observed in a strain of the Blue Lake variety, the inoculated leaves of which developed a more or less extensive

necrotic spotting of the veins and veinlets. Ten to twelve days later, irregular, reddish, necrotic lesions appeared, generally on the upper side of one or more of the trifoliate leaflets, accompanied by reddening of the veinlets and drooping at the pulvini. Infection was frequently confined to one side of the midrib, resulting in the unilateral cessation of growth and consequent distortion. The stems and petioles of diseased plants showed a dark discoloration or deep reddish streaks and became slightly shrunken. A less common manifestation of the virus consists in growth failure or excessive rosetting, chlorosis, thickening, and brittleness of the trifoliate leaves, curtailment, shrinking, darkening, and brittleness of the internodes, and necrosis of the internal tissues. The death of such plants may be delayed for several weeks.

JENSEN (J. H.) & LIVINGSTON (J. E.). **Variation in symptoms produced by isolates of Phytomonas medicaginis var. phaseolicola.**—*Phytopathology*, xxxv, 5, pp. 471–480, 1 fig., 1944.

The writers' studies on the variations in symptoms developing on Red Kidney Beans inoculated through the leaves, stems, germinated seeds, or pods with 13 halo blight (*Phytomonas [Pseudomonas] medicaginis* var. *phaseolicola*) isolates from naturally infected field-grown beans were carried out at the Nebraska Agricultural Experiment Station [*R.A.M.*, xxi, p. 358]. The isolates fell into three main groups on the basis of their pathogenicity to the inoculated plants, viz.: (1) four virulent, producing either all halo or both halo and halo-less primary foliar lesions, typical pod spots and marked stunting, wilting, vein-clearing, and systemic infection, culminating in premature death; (2) mild, characterized by the formation of halo-less primary leaf lesions and a few small pod spots; and (3) five intermediate, usually producing mixed halo and halo-less primary foliar lesions, and representing a transitional stage of pathogenicity between the two extremes. Some of the isolates that produced only halo-less lesions at 28° C. gave rise to the typical halo form at 16° and 22°, while others produced exclusively halo-less lesions at all three temperatures. In direct inoculations by spraying suspensions of macerated tissue from typical halo lesions on young leaves typical halo lesions resulted, whereas suspensions from halo-less lesions caused halo-less lesions. Occasionally the lesions differed from the parent type, indicating that variants are constantly arising.

In all physiological culture tests the characteristics of the various isolates conformed to Burkholder's description [ibid., ix, p. 695].

BURKHOLDER (W. H.). **Xanthomonas vignicola sp. nov. pathogenic on Cowpeas and Beans.**—*Phytopathology*, xxxiv, 4, pp. 430–432, 1944.

A technical diagnosis is given of *Xanthomonas vignicola* n.sp., the agent of a stem canker of Chinese Red Cowpeas in Texas, which proved extremely virulent in inoculation experiments on Red Kidney Beans. It is a strictly aerobic, uniflagellate rod, 1 to 2·8 by 0·46 to 0·92 (average 1·76 to 0·7) μ in 48-hour cultures on beef extract-peptone agar at 27° C., Gram-negative, the colonies on this medium being filiform, glistening, primuline yellow, and butyrous, while on potato dextrose agar they are more luxuriant, mucoid, and pale yellow or colourless. Litmus milk is slowly peptonized and converted in six weeks into a brownish-purple syrup. The minimum, optimum, and maximum temperatures for growth are 6° to 9°, 27° to 30°, and 37°. Gelatine is rapidly liquefied, and hydrogen sulphide produced in tryptone broth, but nitrites are not formed. Ammonium dihydrogen phosphate serves as a source of nitrogen, while the following carbohydrates are slowly utilized, with acid formation: dextrose, galactose, lactose, maltose, sucrose, and raffinose. Starch is hydrolysed and a definite lipolytic action was detected on spirit-blue agar [*R.A.M.*, xxi, p. 517].

X. vignicola differs from the related *X. phaseoli* in various characters. For instance, in milk the former produces a solid curd that persists for some weeks before peptonization begins, whereas the latter clears the medium from the second day onwards without curd formation. *X. vignicola* assimilates mannitol, which is not utilized by *X. phaseoli*; the latter, on the other hand, derives energy from compounds unassimilable by the cowpea pathogen, viz., xylose, glycerol, succinic acid salts, and, to a slight extent, levulose. The temperature relations of *X. phaseoli* likewise differ from those given above for *X. vignicola*, growth being made at 6° but not at 36°. In conclusion, no infection was secured in inoculations with *X. vignicola* on lucerne, *Lespedeza*, and soy-bean, the hosts of three somewhat similar organisms, namely, *X. alfalfae*, *X. lespedezae*, and *X. phaseoli* var. *sojense*, respectively.

HOFFMASTER (D. E.). **Bacterial canker of Cowpeas.**—*Phytopathology*, xxxiv, 4, pp. 439–441, 1 fig., 1944.

In 1942 and 1943, cowpeas in various parts of Oklahoma were attacked by *Bacterium* [*Pseudomonas*] *vignae*, which in the latter year was also observed in Arkansas and, according to A. A. Dunlop (*Plant Dis. Reptr*, xxvii, p. 274, 1943), in Texas. The stems of diseased plants bore prominent, swollen, cracked cankers situated at various points between ground-level and a height of 6 to 8 in. In one field of the Whippoorwill variety the crop was almost totally destroyed by the pathogen. Other susceptible varieties included Wood's Sumptuous, Columbia, and Early Red, while among those showing resistance or the capacity to escape infection may be mentioned Buff or Iron, Victor, Potomac or Calico, Speckled, Crowder, and Brown Crowder.

[This information is also presented in *Sth. Seedsm.*, vii, 2, pp. 16, 40–41, 1 fig., 1944.]

HICKMAN (C. J.). **Shanking of Onion and Shallot associated with species of Phytophthora.**—*Rep. Agric. hort. Res. Sta., Bristol, 1943*, pp. 100–102, 2 figs., [1944].

The information in this paper has already been noticed from another source [*R.A.M.*, xxiii, p. 86].

BRIERLEY (P.) & SMITH (F. F.). **The perennial Tree Onion a carrier of Onion yellow dwarf virus.**—*Phytopathology*, xxxiv, 5, pp. 506–507, 1944.

Experimental evidence is adduced for the transmission of the yellow dwarf virus from the perennial tree onion (*Allium cepa* var. *viviparum*) to commercial onions of the California Early Red variety by means of *Myzus persicae*, the former being a symptomless carrier of the disease. The multiplier onion (*A. c.* var. *solaninum*) was also shown to act as a conveyor of yellow dwarf to Early Reds, but in this case diagnostic symptoms are present. The tree onion is grown fairly extensively in New York State and elsewhere in the northern tier. Infective material of the multiplier was procured from West Virginia.

WALKER (J. C.), EDMUNDSON (W. C.), & JONES (H. A.). **Onion-set production.**—*Fmrs' Bull. U.S. Dep. Agric.* 1955, 21 pp., 18 figs., 1944.

This bulletin, which supersedes the sections on onion sets in *Fmrs' Bull. U.S. Dep. Agric.* 434, includes on p. 19 notes on diseases and their control, abbreviated from *Fmrs' Bull. U.S. Dep. Agric.* 1060, [1919]. Most northern soils are liable to become more or less infested by smut [*Urocystis cepulae*], which persists indefinitely in the soil [*R.A.M.*, xviii, p. 367]. Effective control may be obtained by running a stream of 40 per cent. formaldehyde into the furrow with the seed; a dosage of 1 pint in 8 gals. water at 100 gals. per acre is adequate for the purpose, but a rather

better average result may be expected to follow the use of twice as much of the solution at half strength.

White varieties are much more susceptible than yellow or red ones to smudge [*Colletotrichum circinans*] and neck rot [*Botrytis allii*, *B. byssoidea*, and *B. squamosa*], and particular attention should therefore be paid to the curing of white onions, if necessary by artificial means. *C. circinans* causes only minor shrinkage, but the *B.* spp., under favourable weather conditions, may rapidly destroy the bulk of the crop.

The yellow dwarf virus being perpetuated in bulbs or sets, as well as transmitted by aphids, set crops should be located at a minimum distance of 20 rods from a crop raised from sets or consisting of bulbs carried over from the previous year for seed production.

Massnahmen gegen die Salatfäule. [Measures against Lettuce rot.]—*Gärtn. Rdsch.*, *1943*, 41, 1943. [Reprinted in *Kranke Pflanze*, xxi, 1–2, pp. 14–15, 1944.]

The German lettuce crop is stated to have been severely reduced of recent years by bacterial (*Bacterium* [*Xanthomonas*] *lactucae* and *Bact. aptatum* [*Pseudomonas aptata*]) and fungal (*Sclerotinia sclerotiorum*) rots. Control measures should comprise the removal and burning of diseased material and soil sterilization, preferably in the autumn, with a 1 per cent. formalin solution, which should be sprinkled over the prospective sites of new beds at the rate of 5 l. per sq. in. and the treated area covered with straw matting or the like; planting should not be undertaken within two or three weeks at least. In the case of beds from which the soil is cleared away in the autumn, formalin should be applied by sprinkling at a dosage of 15 to 25 l. per cu. m., the soil being turned continuously during the treatment.

Ogilvie (L.). **Downy mildew of Lettuce. A preliminary note on some greenhouse experiments.**—*Rep. agric. hort. Res. Sta., Bristol, 1943*, pp. 90–94, [1944].

In further studies on lettuce downy mildew [*Bremia lactucae*: *R.A.M.*, xxi, p. 479] the author found infection on the leaves of groundsel (*Senecio vulgaris*) in all parts of the Bristol advisory province, in localities remote from any lettuce plantings, and at all times of the year. The presence of the fungus on this host in England has already been recorded by various writers; it has also been found in this country on sow-thistle (*Sonchus*) and on *Cirsium* sp., while in the Long Ashton plantations heavy infection has been observed on *Senecio vulgaris*, *Sonchus oleraceus*, and *C. arvense*. Jagger found that the strain occurring on lettuce near London in 1926 was distinct from that present on the Composite weeds [cf. ibid., xii, p. 417; xix, p. 577]. The author ascertained, in 1943, that the form occurring on these weeds at Long Ashton does not infect the Cheshunt Early Ball lettuce and, conversely, that two forms found in Somerset on the Cheshunt varieties will not infect *Senecio* or *Sonchus*. In the present instance, therefore, the presence of these infested weeds near the lettuce plantings did not constitute a danger.

The origin of the outbreaks on glasshouse lettuce at Long Ashton remains uncertain. The fungus may, probably, be carried over in the soil from one crop to another in the form of sporangia or oospores. Abundant oospores were found in the blackened parts of groundsel leaves, but oospores have not yet been observed by the writer in lettuce leaves. The disease occurs on outdoor lettuces practically throughout the year, and these may serve as a source of infection for indoor crops. A possible source of infection in badly managed greenhouses is debris reaching the water tanks. An infected leaf floating in water produced viable conidia for at least a fortnight.

The finding of Schultz that a saturated atmosphere was necessary for stomatal penetration by the germ-tubes [ibid., xvii, p. 289] and that of Schultz and Röder that the fungus was unable to fructify until the relative humidity reached 96 per

cent. [ibid., xviii, p. 8] were confirmed by the author, who was generally unable to obtain wholesale infection by spraying with a spore suspension in the open greenhouse or even in a large partitioned-off chamber of a small greenhouse. Satisfactory results were obtained, however, when the seed was sown in steam-sterilized soil in 6-in. pots, these placed on a layer of peat inside 10-in. pots, and the tops of the latter covered by glass, the seedlings being atomized with a spore-suspension of the fungus. In this way, practically complete infection of Cheshunt Early Ball seedlings was obtained, conidiophores being produced on the leaves in five to eight days. Seedlings sprayed while the cotyledons were still folded became heavily infected, and the plants remained capable of being infected until the leaves were at least 4 cm. long, but it was usually difficult to infect mature plants.

When fungicides were applied to the seedlings before spraying with the spore suspension, spraying with half-strength bouisol or with shirlan (1–300) or dusting with materials containing 17·5 per cent. copper gave up to 2 per cent. infection, while an application of ground sulphur gave 5 per cent. infection; the control pots showed over 90 per cent. mildew.

The strain of the fungus occurring on forced lettuces at Long Ashton severely attacked Cheshunt Early Ball, Newmarket (Trocadero), Sutton's Imperial (a Passion lettuce, grown out of doors in winter), and May King, whereas Gotte à forcer was very highly resistant. Golden Ball showed about 5 per cent. infection of seedlings, while Loos Tennisball and Early French Frame (and its Blackpool strain) were not attacked. The second strain of the fungus, obtained from greenhouses at Huntspill, Somerset, on Cheshunt Early Giant, infected equally severely Cheshunt Early Ball, Golden Ball, Gotte à forcer, Early French Frame (and its Blackpool strain), and Loos Tennisball.

It is tentatively suggested that where the disease gives trouble every year in cold houses or frames, trial should be made of one of the resistant varieties mentioned, in case the first strain is present. It is reported, for example, that Loos Tennisball is giving excellent results in Lancashire. If the Cheshunt varieties are grown, the seedlings should be raised in sterilized soil and treated with a copper fungicide or shirlan just after they appear above ground and, if thought necessary, just before transplanting. The houses in which the plants are put out should be watered before planting and, if possible, heated. If the plants become infected after being put out, the lower leaves should be removed, and the temperature raised to 60°–65° F. for at least one night. Watering should not be repeated unless the ground becomes so dry that the plants wilt. The disease can generally be kept under in frames if the lower leaves are removed.

HARTMAN (J. D.). **Results of spraying Watermelons with a copper fungicide.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 585–589, 1943.

After stating that watermelons in south-western Indiana are not sprayed for disease control, though defoliating diseases, particularly *Macrosporium* leaf spot [?*Pleospora herbarum*], are prevalent, the author describes a series of spraying tests carried out on the Hawkesbury variety in 1940–42. The spray consisted of 1·5 lb. of an insoluble copper fungicide (about 50 per cent. copper), 0·4 lb. of a commercial spreader-sticker, and 8 lb. wheat flour in 100 gals. water. In 1940, three applications were made at the rates of 90, 90, and 190 gals. per acre, while in 1941 the corresponding rates were all 170 gals. per acre, and in 1942 they were 320, 320, and 180 gals. per acre. The year 1940 was very dry, and leaf diseases were at no time extremely destructive. In 1941, there were 11 days with some precipitation in July, and by 10th August leaf diseases were very prevalent. In 1942, July was nearly as wet as it had been the year before, but leaf diseases developed more slowly.

In 1940, the sprayed plants gave a total yield of No. 1 quality fruits of 24,046 lb.

per acre, as against 23,030 lb. for the unsprayed. In 1941, the yield of No. 1 quality and marketable fruits amounted to 14,338 lb. per acre for the sprayed plants and 11,154 lb. for the unsprayed; while in 1942, the corresponding figures were 28,158 and 25,677 lb. Refractometer studies on the juice of ripe melons in 1941 showed that late in the season the quality of the sprayed fruits (refractive index 9·2) was far superior to that of the unsprayed (7·7).

The annual cost of the spraying is estimated at $10.50 to $12 per acre. With farm prices for melons at the usual level, spraying would have paid in the wet season of 1941, but not in 1940 or 1942, when slightly better financial returns might have been obtained from the unsprayed than from the sprayed plots. Taking the three years as a whole, spraying would have brought no profit, unless exceptionally high prices had obtained, or a premium had been paid for quality. Spraying, however, would be necessary in a watermelon business that demanded a dependable supply of quality fruit.

Dufrénoy (J.). **Some physiological relations of virus-infected plant tissues.**—*Biodynamica*, iv, 91, pp. 171–184, 1943.

This is a review of the literature on the development of the notions of (*a*) chlorophyll disintegration as correlated with enhanced oxidase activity in virus-diseased plants, and (*b*) cytochemical and cytophysiological relationships between virus nucleoproteins and chromoplast chromoproteins.

Darlington (C. D.). **Heredity, development, and infection.**—*Nature, Lond.*, cliv, 3901, pp. 164–169, 3 figs., 1944.

The author concludes after a review of the evidence that proteins in the cytoplasm can now be put in a rough genetic classification. On the one hand, there are proteins put together by the nucleus with the help of desoxyribose nucleic acid. These need not be self-reproducing. On the other hand, there are other proteins, plasmagenes and viruses, formed in the cytoplasm only from pre-existing proteins of similar type. These nuclear types depend for their reproduction on ribose nucleic acid and are conditionally self-perpetuating. The plasmagene is a protein which can be made outside the nucleus and comes to be inherited through the egg. The virus is a similar protein which is capable of being acquired later. It is a protein which prospers through being in the wrong organism and gets there by infection. Both classes are very heterogeneous. In addition, both are considered to be continuously arising *de novo* and rapidly evolving on account of the high frequency of their mutations and the rapidity of their selection.

Carson (G. P.), Howard (H. W.), Markham (R.), & Smith (K. M.). **Paracrinkle virus and inheritance.**—*Nature, Lond.*, cliv, 3906, p. 334, 1944.

Referring to Darlington's recent article [see preceding abstract], the authors interpret his comments on potato paracrinkle in relation to the protein of one plant genotype becoming a destructive agent in another as implying that a protein constituent of King Edward becomes a virus on transference by grafting to another potato variety. They state that whatever evidence there is does not support this view.

The virus of potato paracrinkle is not transmitted through the seed. Thus, 22 seedlings from the cross King Edward female × Flourball were grafted on Arran Victory, and in no case was the paracrinkle virus present in the seedlings. Paracrinkle, therefore, like most viruses and not like a plasmagene, can be transmitted by grafting to certain potato varieties that carry it without symptoms, e.g., President. From such infected President plants other susceptible varieties, such as Arran Victory, can also be infected in series. There appears to be no fundamental

difference between the reaction of King Edward to paracrinkle and that of any other 'carrier' variety to the virus carried.

HADDOW (A.). **Transformation of cells and viruses.**—*Nature, Lond.*, cliv, 3902, pp. 194–199, 1944.

This paper, concerned mainly with cancer research, includes a discussion on the origin and nature of plant viruses as interpreted by Darlington [see above].

Eighteenth Annual Report of the Department of Scientific and Industrial Research, New Zealand, 1943–1944.—57 pp., 1944.

In this report [cf. *R.A.M.*, xxiii, p. 4] it is stated that further information has been collected in New Zealand on the incidence of different fungi infecting house timbers. Discoloration of ceilings and walls was due mainly to *Cladosporium herbarum* and to a less extent to species of *Penicillium* and *Aspergillus*. These organisms were completely controlled by the addition of 2 per cent. of sodium pentachlorphenate [santobrite] to the glue size, casein distempers, and flour paste used.

Jonathan apples kept in refrigerated gas storage for 154 days in an atmosphere maintained at 8 per cent. carbon dioxide and 13 per cent. oxygen showed brown heart [ibid., xxi, p. 406] after two months, but the condition did not increase appreciably afterwards. The largest fruit showed 22 per cent. brown heart as against 5 per cent. for the smallest. Breakdown and fungal infection were beginning to appear at the final inspection. No Jonathan spot was present.

Sturmer apples were stored at 35°, 38°, and 41° F. in atmospheres containing varying percentages of carbon dioxide and oxygen. In general, the fruit held at 35° was severely affected by internal breakdown, while that kept at 41° developed severe superficial scald. No brown heart appeared in atmospheres containing 5 per cent. carbon dioxide with 16 or 10 per cent. oxygen.

Wrapping Granny Smith apples in oiled paper for three weeks at progressive stages of the storage life again demonstrated that the greatest protection against superficial scald occurred from the ninth to the twelfth weeks after commencement of storage. Fruit kept in oiled wraps during most of the storage period, but left unwrapped for three weeks at a time at progressive stages in its storage life again remained free from scald throughout the 24 weeks the experiment lasted. Core-flush [ibid., xviii, p. 187] was the only other disorder occurring during the commercial life of the fruit, and was unaffected by wrapping.

Granny Smith apples of two picks, stored in plain and oiled wraps, were subjected to delayed storage at weekly intervals up to six weeks. Core flush and the form of breakdown that arises from extension of core flush into the cortex were decreased by delay before storage in all except one sample. Fungal activity increased after four weeks' delay, after which, also, the colour of the fruit became excessively yellow. Thus, even apart from the question of scald, a delay of over four weeks between harvesting and storing could not be recommended. Oiled wraps delayed the first appearance and reduced the severity of scald.

In further studies on the effect of manurial treatments on the storage quality of apples, the complete PNK treatment gave fruit, in the case of Cox's Orange Pippin, as resistant to fungi and wilt as the untreated controls, and much more resistant to breakdown and storage pit. Fruit of this variety from nitrogen-treated trees was again outstanding for its high susceptibility to breakdown and fungal attack.

Jonathan apples grown on East Malling No. XII stock were much less subject to internal breakdown than when grown on Northern Spy or Malling types I or XV. Fruit on M I appeared to be rather less resistant than the others to ripe spot [*Neofabraea malicorticis*: ibid., xxiii, p. 5].

Three years' field experiments demonstrated that adequate control of apple ripe spot follows the use of Bordeaux mixture in January and February. Spray injury to the fruit may be reduced by increasing the quantity of hydrated lime or adding cottonseed oil. Applications of Bordeaux mixture to fruit after picking did not improve control and materially increased spray residues. When kept in cool storage, the sprayed fruits showed marked freedom from *N. malicorticis* and soft rots. Spraying in late summer controlled black spot [scab: *Venturia inequalis*] in cool storage.

In field tests made to ascertain the possibility of reducing apricot brown rot [*Sclerotinia fructicola*: ibid., xxi, p. 123], shirlan AG gave a high degree of control under severe test conditions, whereas sulphur was ineffective and caused fruit blemish. Substantial control of plum bacterial spot [*Xanthomonas pruni*: ibid., xxi, p. 2] was secured by spraying with Bordeaux mixture, though some spray injury resulted.

Further tests of the resistance of some 83 lines of beans to bacterial wilt [*Pseudomonas medicaginis*], anthracnose [*Colletotrichum lindemuthianum*], and mosaic [ibid., xxiii, p. 284] confirmed earlier results, showing that runner varieties are resistant to all three diseases, that the Burnley selections of Canadian Wonder and Dun French beans are highly resistant to *P. medicaginis* and mosaic, though the former is susceptible to *C. lindemuthianum*, that white-seeded varieties are highly resistant to *P. medicaginis*, and that Black Prince, Blue Pod, Wood's Centenary, Dun, and Zulu King are moderately resistant to all three diseases.

A survey of flax crops in four areas showed browning (*Polyspora lini*) present in only one crop, though in previous seasons it had been widely distributed. A species of *Phoma* was isolated from three crops, associated with a canker near the base of the stem. Rust (*Melampsora lini*) was present in all crops to a slight extent, but caused moderate or severe infection only in a few late-sown ones; it was common on the introduced *Linum marginale*.

More seed of the Vetomold tomato, which is resistant to leaf mould (*Cladosporium fulvum*), was distributed to growers. In some localities, individual plants of this variety have been found to be infected, indicating that a strain of the fungus to which Vetomold is not resistant has appeared. Efforts are in progress to produce F_2 plants resistant to both strains, and also to develop a resistant dwarf variety.

The presence of the fig mosaic virus [ibid., xx, p. 542] was demonstrated, this being a new record for New Zealand. Passion fruit grease spot [*Phytomonas passiflorae*: ibid., xviii, p. 235] was controlled by autumn spraying with Bordeaux mixture (3–4–50), provided the vines were pruned and trained on wires. Applications of Bordeaux mixture and cuprox materially reduced infection by ring spot (*Marssonina panattoniana*) [ibid., xx, pp. 102, 191] on winter-grown lettuces and considerably increased yields. Concentrated Bordeaux sprays did not prevent onion downy mildew [*Peronospora destructor*] from spreading from the sprayed to unsprayed plots, but increased yields by 18 per cent. over the latter. Cuprox was again superior to Bordeaux mixture against tomato late blight [*Phytophthora infestans*]; it was much less injurious to the plants, with the result that yields were increased, and it also gave adequate control of the disease. Of five lines of swede seed grown in New Zealand only one showed the presence of *Phoma lingam*, and then infection amounted to only 0·1 per cent.

Officers of the Tobacco Research Station and the Cawthron Institute cooperated in an investigation of tobacco mosaic. In the seedling bed the application of milk sprays conferred significant protection against virus infection through wounds, but when the leaves were not bruised the use of a virus spray did not result in heavy mosaic. Both tannin and milk sprays in tests in another locality significantly reduced mosaic in seedling beds where the plants had previously

been inoculated with the virus. The virus can persist in infected soil at least four months after the incorporation of infected tobacco trash. Weed transmission appears to be likely only in the case of *Solanum nigrum*.

Black root rot [*Thielaviopsis basicola*] was isolated for the first time during the period under review from stunted tobacco plants taken from a commercial field at Dovedale. Three more cases of infection were identified at Umukuri and Motueka. Angular leaf spot [*Pseudomonas angulata*] was identified in both living and cured tobacco leaves, and all the strains isolated gave positive results when inoculated into tobacco plants. Heavy rain may cause distribution of the bacteria, with resultant coalescence of the spots and considerable damage to the leaf. One case of tobacco *Verticillium* wilt [*V. albo-atrum*: ibid., xiv, p. 200], was found.

New records other than those mentioned above include *Entyloma calendulae* on marigold [*Calendula officinalis*], *Cylindrosporium concentricum* on cauliflower, *Ramularia primulae* on *Polyanthus*, and *Bacterium* [*X.*] *pruni* on peach.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lv, 8, pp. 331–335, 6 figs., 1944.

Bacterial canker [*Corynebacterium michiganense*: *R.A.M.*, xxiii, pp. 193, 219] has been present for about ten years in the commercial tomato-growing areas of New South Wales, but it did not assume the importance of a major disease until 1943. In 1944, owing to the presence of the disease in seed crops on Lord Howe Island and the importation of infected seed from this locality and, possibly, from other States, heavy and general losses were sustained. Fruit symptoms are seldom seen except after wet weather or where spray irrigation is used. The spots are small, round, flat, snow-white, the centres becoming raised, tan-coloured, and rough, while the halo remains white and flat. Bacterial spot [*Xanthomonas vesicatoria*: ibid., xix, p. 518] is both less serious and less widespread. Almost all the tomato seed to be distributed in New South Wales in the coming season has been treated by the acetic acid steep [ibid., xxi, p. 353; xxiii, p. 219]. During the past season, this has proved remarkably effective against canker; it should also eliminate spot.

Stone fruit freckle (*Cladosporium carpophilum*) [ibid., xx, p. 558] is commonest in the coastal areas, particularly affecting mid-season and late peaches and nectarines. Control on these hosts consists in spraying with Bordeaux mixture (6–4–40) or lime-sulphur (1 gal. per 20 gals. water) at late bud-swell, and with lime-sulphur (1 gal. per 160 gals.) during the first week of October, three or four weeks later, and (except in the case of mid-season varieties) eight or nine weeks before harvest. Colloidal sulphur 1 to 2 lb. or wettable sulphur 5 lb. per 100 gals. may be used instead of the lime-sulphur in the second, third, and fourth applications. A spreader should be employed at all stages. With badly affected trees, the first season's adoption of spraying can be supplemented by hard pruning. After three consecutive seasons' spraying, the programme can be discontinued. On apricots, control usually follows spraying with Bordeaux mixture (6–4–40) in the early spring, at the red-bud stage. Sulphur sprays should not be applied to coastal varieties of apricots.

The paper concludes with recommendations for the control of tomato diseases.

Mujica (F.). **Hongos chilenos no mencionados anteriormente en la literatura.** [Chilean fungi not previously mentioned in the literature.]—*Bol. Sanid. veg. Chile*, iii, 1, pp. 33–35, 1943.

A list is given of the fungi not previously recorded in the relevant literature on 41 hosts in Chile, of which the following may be mentioned: *Ustilago perennans* on *Avena elatior*, *Puccinia coronata* and *P. rubigo-vera* on *A. fatua*, *Ophiobolus graminis* on wheat, *Erysiphe graminis* on oats and barley, *Neocosmospora vasinfecta* on watermelon and *Cucurbita maxima*, *Uromyces caryophyllinus* on carnation,

Ascochyta pisi on lentils and broad beans, *Myxosporium corticola* on apple, *Taphrina cerasi* on cherry, *P. pruni-spinosae* on plum, *Fusarium sambucinum* and *Verticillium lateritium* [*Acrostalagmus cinnabarinus*] on potato, and *Sclerotinia minor* on red clover.

Principales enfermedades de origen parasitario que fueron objeto de consulta en el semestre Enero–Junio de 1943. [The principal diseases of parasitic origin which were the object of consultation during the half-year January to June, 1943.]—*Bol. Sanid. veg. Chile*, iii, 1, pp. 38–39, 1943.

The following parasitic diseases, besides those already reported, engaged the attention of the phytopathological staff of the Chilean Ministry of Agriculture during the period under review [cf. *R.A.M.*, xxiii, p. 254]: *Alternaria solani* on tomato, *Ascochyta syringae* on lilac, *Botryosphaeria ribis* on lemon [cf. ibid., xxi, p. 524], *Cercospora beticola* on beet, *Cintractia sorghi* on *Holcus sorghum* var. *technicus* [*Sorghum bicolor* var. *technicus*], *Puccinia sorghi* on sorghum, *P. menthae* on peppermint, and *Uromyces phaseoli* [*U. appendiculatus*] on beans.

Diachun (S.) & Valleau (W. D.). **Growth and overwintering of plant pathogenic bacteria on wheat roots.**—Abs. in *J. Bact.*, xlviii, 1, pp. 122–123, 1944.

Xanthomonas vesicatoria, *X. phaseoli* var. *sojense*, and *Bacterium* [*Pseudomonas*] *medicaginis* var. *phaseolicola* grew and formed colonies on the surface of wheat roots, and less freely on those of beans and soy-beans, under aseptic conditions. *X. vesicatoria* was recovered in five trials between 13th December, 1943, and 14th March, 1944, from the roots of wheat plants growing outdoors in unsterilized soil inoculated with the pathogen on the previous 10th November. Isolation was effected by washing the roots in running water, crushing them in water, and pouring the resultant suspension on the lower surface of tomato leaves, the development of spots on which indicated the presence of the bacterium.

White (N. H.). **The generic names of bacterial plant pathogens.**—*J. Aust. Inst. agric. Sci.*, x, 2, pp. 78–79, 1944.

The author follows Dowson [*R.A.M.*, xxii, p. 345] in adopting the generic names *Corynebacterium* Lehmann & Neumann, *Bacterium* Ehrenberg emend. Dowson, *Pseudomonas* Migula emend. Dowson, and *Xanthomonas* Dowson, and rejecting *Erwinia*. A key to these accepted genera is provided.

Pichler (F.). **Nassbeizverfahren mit Trockenbeizmitteln.** [The use of dusts in liquid methods of disinfection.]—*Z. PflKrankh.*, liii, 8–12, pp. 286–288, 1943.

At the Vienna branch of the Biological Institute, the writer carried out experiments to determine the possibility of utilizing a single cereal seed-grain disinfectant, either as a dust or by the immersion, sprinkling, or short-liquid processes. Such a combination would be a great advantage, not only by reason of the resultant simplification of the preparation and sale of the fungicide, but also to the purchaser, who can then apply it by any method that circumstances may dictate at the time of treatment. For this purpose four dusts (designated by the numbers I to IV) were compared with three preparations, viz., two liquids (A & B) and a dust (C), all except the last-named, which was used exclusively in the dry state, being applied by the four above-mentioned procedures. The amounts of the fungicides used for the liquid treatments uniformly corresponded with those prescribed for the dusting of the particular cereal concerned, irrespective of the volume of water required in each case, i.e., for 100 kg. wheat or barley 200 gm. and for 100 kg. oats 300 gm. The volumes of water necessary for the treatment of 100 kg. wheat by immersion, sprinkling, and short-liquid were 100, 10, and 3 l.,

respectively, the corresponding quantities for barley being 120 to 150, 12, and 3 l., respectively, and for oats 150 to 180, 15, and 4 l., respectively.

In general, the control of barley stripe [*Helminthosporium gramineum*], loose smut of oats [*Ustilago avenae*], and wheat bunt [*Tilletia caries* and *T. foetida*] by dusts in liquid form were quite satisfactory, only No. I permitting the development of more than a trace, whereas the controls were heavily infected. These results encourage hopes for the commercial development of a seed-grain disinfectant applicable by any of the current modes of treatment.

SUNESON (C. A.). **Year-around occurrence of stem rust of Wheat (Puccinia graminis tritici) in California.**—*Plant Dis. Reptr*, xxviii, 11, pp. 410–413, 1944. [Mimeographed.]

Observations since early in 1941 indicate that wheat stem [black] rust (*Puccinia graminis tritici*) overwinters at Davis, California, and is present there through the other seasons of the year [cf. *R.A.M.*, xix, p. 463]. At all times, the infection centres are invariably discernible for two or three generations, notwithstanding appreciable wind movement. This localization introduces a serious problem in yield nurseries where spread is conditioned exclusively by inoculum from the vicinity. For instance, of the three crops, 1941, 1942, and 1943, only that of the first year was exposed to spore showers from a general epidemic that was first reported in Lower California, Mexico, in February, spread into the Imperial Valley in March, and thence northwards in California and eastwards into Arizona, until in July rust was generally distributed over the sparse wheat fields of Nevada. Even in that year, however, the evidence of infection in the nurseries at Davis was far from uniform, and in 1943 late varieties north of the original rust focus on the susceptible Ramona were severely damaged during the last fortnight of May, whereas those to the south were practically uninjured. A collection made on 18th April of that year was identified as race 56 of *P. g. tritici*.

HOLTON (C. S.). **Inheritance of chlamydospore and sorus characters in species and race hybrids of Tilletia caries and T. foetida.**—*Phytopathology*, xxxiv, 6, pp. 586–592, 2 figs., 1944.

In eight out of 32 hybrids between *Tilletia caries* and *T. foetida* [*R.A.M.*, xxii, p. 200], the smooth character of the chlamydospores of the latter species was completely dominant over the reticulate markings typical of the former, while in the remaining 24 the factor governing the development of reticulations partially predominated over that conferring smoothness. Variability in the reticulation type and spore dimensions was observed in the F_1 of some of the 23 hybrids between seven physiologic races within the two species (including dwarf wheat bunt) [ibid., xx, p. 158; xxi, p. 284].

Segregation and recombination of factors for chlamydospore characters occurred in the F_2 of the interspecific and interracial hybrids. This generation ordinarily comprised spores resembling both parents and different from both, but in one interspecific cross none of the smooth-type spores of *T. foetida* were represented in the progeny.

Certain differences between the sori of crosses between races T–9 and L–8 and those of the parents, notably the smaller dimensions of the former, are interpreted as indicative of genetic control of the sorus characters.

VOGEL (O. A.), CLASSEN (C. E.), & GAINES (E. F.). **The inheritance of reaction of Turkey–Florence 1 × Oro–1 to race 11 of Tilletia tritici.**—*J. Amer. Soc. Agron.*, xxxvi, 6, pp. 473–479, 1944.

Three crosses, consisting of the three possible combinations of Oro–1, Turkey–Florence–1, and Selection 9 of Turkey–Florence, were studied at the Washington

Agricultural Experiment Station for their reaction to race 11 of *Tilletia tritici* [*T. caries*: cf. *R.A.M.*, xxi, p. 519]. The F_1, F_2, and F_3 generations of all three crosses and six F_4 families of Turkey–Florence–1 × Oro–1, selected at random, were tested during 1940 under identical environmental conditions, and a further five F_4 families in 1941.

At least three factors, two major and one minor, appeared to be concerned in the segregation of reaction of Turkey–Florence–1 × Oro–1, the latter (more resistant) parent carrying the two major dominant factors and the former the one minor dominant. The mode of segregation of the crosses of Selection 9 with Oro–1 and Turkey–Florence–1 indicates that the first-named carries one of the two major factors of Oro–1 and the minor factor of Turkey–Florence–1. Three of the arbitrarily selected 11 F_4 families appeared to be derived from homozygous genotypes, one resembling Oro–1, the second Turkey–Florence–1, and the third combining all three factors of the two parents. Each of seven F_4 families seemed to proceed from a different heterozygous genotype, one segregating for three factors, three for two, and one for one factor. One F_4 family was evidently derived either from a genotype segregating for one factor or from a mixture of two genotypes, each segregating for one factor.

The presence of the new race, T–13, in the T–11 inoculum [ibid., xxi, p. 329] did not modify the so-called T–11 responses in a noticeable manner.

MERRITT (P. P.) & AUSEMUS (E. R.). **Effect of scab on the quality of hard red spring Wheat.**—*Cereal Chem.*, xxi, 3, pp. 199–209, 1 graph, 1944.

The effect of scab (*Gibberella zeae*) on the physical and chemical properties, milling, and baking value of four hard red spring wheats, Thatcher, Regent, Ns. 2829, and Ns. 2822, was studied in Minnesota, where the disease constituted a serious problem in 1941 and 1942. Infection was shown appreciably to lower the test weight (by 6 lb. per bush.) and weight per 1,000 kernels (by 7·9 gm.), and to reduce the apparent specific gravity of the kernels, while there was also a slight but significant decrease in the flour yield of diseased samples. The ash and reducing sugar contents of the flours milled from the scabby wheats were somewhat, and the carotinoid pigment content considerably higher than those of the corresponding products from sound samples. Various undesirable characteristics of the dough made with flour from infected wheats (wet, sticky surfaces, tendency to collapse, production of bread with an unduly dark crust and a dull yellow crumb, and so forth), could be greatly minimized by blending with flour from healthy material. Even when the blends contained 30 per cent. 'scabby' flour, the handling properties of the dough were normal and the resultant loaf presented a reasonably attractive appearance, besides comparing favourably in value with the product of sound material.

BELL (G. D. H.). **Ear tipping in Wheat.**—*J. Minist. Agric.*, li, 7, pp. 318–319, 2 figs., 1944.

Wheat in the Cambridge area this year has shown a condition marked by white, shrivelled tips and upper parts of the ears. The proportion of the ear affected varies widely with different crops and also within the same field, but all cases show dead spikelets with no grain developing.

Examination of small plots of single plant selections from a Continental winter wheat showed that the condition did not occur in some selections, slightly affected others, and in two or three caused such severe damage that more than half the ear was white and shrivelled. The unaffected plants were those which had shown early ear emergence. Plants in the centre of each plot, where growth was poorest, were much more severely affected than the better-grown border plants. In most cases, the plants with the most severely affected ears were poorly grown and much

shorter in the straw than those with undamaged ears. On some plants the earliest ears were unaffected while the back tillers showed damaged ears. It was also noted that only that part of the ear that was exposed above the leaf sheath was damaged.

It is concluded that the condition was probably due to cold weather during flower development. Dry conditions accompanying the cold probably aggravated the damage.

Bretz (T. W.). **Wheat mosaic survey in Illinois and Missouri, and notes on other Wheat diseases.**—*Plant Dis. Reptr*, xxviii, 12, pp. 418–419, 1944. [Mimeographed.]

An inspection of some 90 Illinois wheat fields during the week ending 29th April, 1944, revealed an incidence of about 38 per cent. mosaic, which it was estimated would reduce the harvest by 50 per cent. or so. The symptoms of the disease were generally inconspicuous, but in a few instances of severe infection the yellowing and stunting of the plants were apparent from a distance. During the following week, the same disease was observed in a mild form in several counties of Missouri, from which State it had not previously been reported. Speckled leaf blotch (*Septoria tritici*) was prevalent in both States.

Chester (K. S.). **A cause of 'physiological leaf spot' of cereals.**—*Plant Dis. Reptr*, xxviii, 15, pp. 497–499, 1944. [Mimeographed.]

Physiological leaf spot, not associated with pathogenic organisms, though saprophytic bacteria, *Alternaria* spp., and other weed fungi may be found in older lesions, is characteristic of certain cereal varieties. Examples include the leaf-spotting of Chiefkan wheat, the surest means of distinguishing this variety from Red Chief, and that on Kareela oats, commonly known as 'Kareela spot' because it is so characteristic of this variety.

When 80 hybrid lines of wheat developed for resistance to leaf rust [*Puccinia triticina*] were being subjected to a relative humidity of 100 per cent. at 65° F. for 12 hours every night, it was found that every morning the leaves of many of them were stippled with numerous small, translucent, water-soaked lesions, which in most cases disappeared half-an-hour after the canvas cover was removed, the leaves regaining their normal appearance. In a few hybrids, however, recovery did not take place. The lesions persisted, the cells in them dying and giving rise to small, necrotic lesions in place of the water-soaked ones. No organism was found in the necrotic lesions which exactly resembled physiological leaf spot as seen in the field. Meantime, the same 80 hybrids were being grown in the field, and when these were examined after rain, physiological leaf spot was found on, and only on, the same few hybrids in which water-soaking in the greenhouse had been followed by necrotic breakdown of the tissues.

It is concluded that some wheat strains are, owing to physiological factors, unable to recover without injury from water-soaking due to high humidity. This inherited fault is, in some cases at least, the cause of physiological leaf spot.

Shands (H. L.) & Arny (D. C.). **Stripe reaction of spring Barley varieties.**—*Phytopathology*, xxxiv, 6, pp. 572–585, 1944.

The writers describe the methods and discuss and tabulate the results of their eight years' tests at the Wisconsin Agricultural Experimental Station on the reaction to stripe (*Helminthosporium gramineum*) of 375 spring barley varieties and selections [*R.A.M.*, xiii, p. 155], the germinating kernels of which were inoculated with mycelial suspensions from autoclaved wheat (15 gm.) and water (15 c.c.) cultures.

The incidence of infection in the Oderbrucker (C.I. 4666) variety, used as a check

in 91 inoculations, amounted to 75 per cent. and 12 varieties contracted upwards of 90 per cent., whereas 31 showed no infection. From the plant-breeding standpoint, however, interest centres on the 52 resistant varieties with less than 15 per cent. stripe, which included Korsbyg, White Gatami (C.I. 918), Trebi (C.I. 920), Chevron (C.I. 936), also resistant to stem rust [*Puccinia graminis*], mildew [*Erysiphe graminis hordei*], and scab [*Gibberella zeae*: ibid., xviii, p. 388], Cross (C.I. 1613 and C.I. 2492), Chinese Black (C.I. 1969), Gatami (C.I. 2276), Dorsett (C.I. 4821), Wisconsin Barbless (C.I. 5105), and Cebada 97 A (C.I. 6352).

SHEAR (G. M.) & WINGARD (S. A.). **Some ways by which nutrition may affect severity of disease in plants.**—*Phytopathology*, xxxiv, 6, pp. 603–605, 1944.

The writers and others have obtained experimental evidence of a relationship between certain unbalanced conditions in the mineral nutrition of a host plant and the virulence of infection by vascular pathogens, and in this connexion attention is specially directed to McNew and Spencer's studies on the effect of nitrogen on the bacterial wilt of maize *Xanthomonas stewarti*: *R.A.M.*, xix, p. 208]. The information at hand appears to indicate that the observed increase in the severity of the disease in potassium-deficient seedlings is due to an accelerated rate of bacterial multiplication resulting from the increase in nitrate nitrogen in the conductive tissue, which in turn is consequent on the shortage of potassium. Assuming this interpretation to be correct, if the severity of attack by a pathogenic organism is accentuated by the application of an excess of nitrogenous fertilizer, but not by a deficiency of potassium, the inference is that the parasite is unable directly to utilize the nitrate nitrogen within the host. There is also a possibility that similar effects may be induced by the succulence of the host tissues, or more probably by the presence, in excessive quantities, of some complex nitrogen compound essential to the growth of the pathogen.

HARRIS (M. R.). **A study of fungi parasitic on Ohio seed Corn.**—*Plant Dis. Reptr*, xxviii, 9, p. 329, 1944. [Mimeographed.]

The tabulated results of germination tests carried out in 1943–4 by the Ohio Seed Improvement Association on a large number of maize samples, mostly of the 1943 crop but also comprising some material of 1942 and earlier, reveal a generally low incidence of the pathogenic fungi, *Aspergillus* sp., *Nigrospora sphaerica*, *Diplodia zeae*, *Fusarium moniliforme* [*Gibberella fujikuroi*], *G. zeae*, and *Penicillium* sp. The last-named species was the most prevalent, occurring on 1·49 per cent. of 75 small lots of 1943 hybrid seed maize, 1·07 per cent. of 84 similar lots of 1942 and earlier material, and 3·03 per cent. of 117 lots of inbred and single-cross seed.

PADY (S. M.). **The distribution of Milo disease in central and western Kansas as determined by soil samples.**—*Plant Dis. Reptr*, xxviii, 10, pp. 356–358, 1 map, 1944. [Mimeographed.]

The examination of 52 soil samples collected from sorghum fields in 37 counties of central and western Kansas between 20th September and 1st October, 1943, revealed the presence of milo disease (*Pythium arrhenomanes* and other factors) [*R.A.M.*, xxiii, p. 101] in 33, making a total, with the two eastern counties known to be infested, of 35 for the State.

UPPAL (R. N.) & PATEL (M. K.). **Long smut of Sorghum purpureo-sericeum.**—*Indian J. agric. Sci.*, xiii, 5, pp. 520–521, 1 pl., 1943.

Tolyposporium ehrenbergii var. *grandiglobum* n.var., common on the wild grass *Sorghum purpureo-sericeum* at Khadesh, Bombay Province, differs from *T. ehrenbergii* [*R.A.M.*, xix, p. 331] in the larger dimensions of its spore balls (45

to 239·9, mean 106·7 μ in diameter compared with 30 to 119·9, mean 67·5 μ) and the greater numbers of spores in each ball (exceeding as against less than 50).

Yu (T. F.). **Inheritance of kernel smut resistance in Millet crosses.**—*Sci. Rec., Chungking*, 1, 1–2, pp. 248–250, 1942. [Received July, 1944.]

A study was carried out at the University of Nanking on the correlation between reaction to kernel smut (*Ustilago crameri*) and seed-coat colour in the parents and progenies of five millet [*Setaria italica*] crosses, viz., N2 × N65, N18 × N65, N36 × N65, N18 × N84, and N36 × N84, of which N2, N18, and N36 were resistant and N65 and N84 susceptible to the disease [*R.A.M.*, xvi, p. 741]. The seed-coat colour of the three resistant parents was buff and that of the two susceptible red. The crosses were made in 1934 and the F_1 progeny were back-crossed with their respective resistant parents in the following year. The F_2 seed, taken at random from F_1 plants, was heavily inoculated with smut spores and sown at a spacing of 4 in. in rod rows of 1 ft. apart.

Classing all plants that exhibited any degree of infection as susceptible and those showing none as resistant, 245 out of a total of 317 would fall into the latter. A calculation of this result on a 3 : 1 ratio basis gave a p value of 0·41. In back-crosses of the F_1 offspring with N2, 396 plants segregated into 215 resistant and 181 susceptible, a computation of which on a 1 : 1 ratio basis yielded a p value of 0·089. An arbitrary sampling of 127 resistant plants produced 45 F_2 families homozygous and 82 heterozygous for resistance, the expected numbers in each class being 42·33 and 84·67, respectively. Five of the heterozygous lines segregated into resistant and susceptible plants in the following ratios: 144 : 45, 137 : 39, 142 : 54, 139 : 47, and 130 : 28, giving a total of 629 resistant and 213 susceptible, compared with expectations of 678·57 and 226·25, respectively. The result approximated a 3 : 1 ratio, with a p value of 0·27, indicating that resistance to *U. crameri* is dominant and governed by a single-factor difference in N2 × N65.

The seed-coat colour of the same cross segregated in the F_2 into 242 varying shades of buff and 75 red plants, again in a ratio of roughly 3 : 1. The reaction to kernel smut was studied in four F_2 groups, namely, buff seed coat resistant, ditto susceptible, red seed coat resistant, and ditto susceptible. There were 185 buff resistant plants, 57 buff susceptible, 60 red resistant, and 15 red susceptible, denoting the absence of linkage between the factors for seed-coat colour and smut reaction.

Stevenson (J. A.) & Johnson (A. G.). **The nomenclature of the Broomcorn Millet smut fungus.**—*Phytopathology*, xxxiv, 6, p. 613, 1944.

Adherence to the International Rules of Botanical Nomenclature in the publications of the United States Department of Agriculture involves changes in a number of fungus names in common use, notably those applied to the cereal smuts. Only in one instance, however, has it been deemed necessary to adopt a new binary name, and that is for the smut of *Panicum miliaceum* ordinarily known as *Sphacelotheca panici-miliacei* (Pers.) Bub. The smut was originally listed by Persoon in 1801 as *Uredo segetum* subsp. *panici-miliacei*, but under the provisions of section 11, article 58, of the Rules, the first legitimate specific epithet is *destruens*, applied by Schlechtendahl in 1824 to *Caeoma*. No previous transference of the latter genus to *Sphacelotheca* having apparently been made, *S. panici-miliacei* accordingly becomes *S. destruens* (Schlecht). comb. nov.; a list of its eight synonyms is given.

Garcia (A.). **Gomosis esclerotiniosa en los Citrus.** [Sclerotinious gummosis in Citrus.]—*Bol. Sanid. veg. Chile*, iii, 1, pp. 31–32, 1943.

Sclerotinia sclerotiorum was ascertained to be the agent of citrus gummosis in the province of Santiago, Chile, where the first determination was made on lemons

on 20th August, 1940. The incidence of the disease is estimated at 5 per cent. Infection originates at the tips of the buds and in the flowers, and proceeds under favourable climatic conditions, viz., low or moderate temperature, high atmospheric humidity, and periodical mists and cloudy skies, to girdle the twigs and branches, resulting in the wilting of the contiguous area. Following exposure to atmospheric agencies, the diseased twigs acquire a streaky and fibrous aspect and the cortical tissues exude a considerable quantity of gum, which subsequently dries. The black sclerotia of the fungus develop on and under the cortex of the trunk and main branches, the twigs also being occasionally involved. Entry is effected through lesions caused by frost, sun scorch, agricultural implements, animal bites, and the like. Control measures should include scarification of the diseased bark, burning of infected refuse, and preventive applications of 1 per cent. Bordeaux mixture.

RHOADS (A. S.). **Condition of Citrus groves in Florida.**—*Plant Dis. Reptr*, xxviii, 17, pp. 568–573, 1944. [Mimeographed.]

In February, 1944, citrus trees in the vicinity of Cocoa, Brevard County, Florida, were found to show marked distress as a result of prolonged drought. Many groves west of Vero Beach and Fort Pierce were affected by wither-tip, as well as by general wilting and dying-back of the tops and heavy fruit drop. Where the groves were adequately irrigated, the trees were in good condition. Citrus decline at Wabasso was associated with an excessively high water-table. At Davie (Broward County) citrus trees on muck soils have declined for several years, the trouble usually beginning when the trees are 12 to 14 years old.

An alarming form of decline was found at Winter Haven. In one grove, producing 400 to 500 boxes of fruit per acre some years ago, the trouble occurred on grapefruit, orange, and tangerine trees on rough lemon stock, grapefruit trees being most severely affected. The trouble started on one tree six or seven years ago, and spread until almost every tree over an area of 7 to 8 acres became affected, when the condition began to appear in an adjacent block of Valencia oranges. Irrigation gave only temporary improvement, and fertilizer treatments and soil amendments had no effect. When the trees were examined they were characterized by sparse foliage and small leaves, which showed signs of zinc and magnesium deficiency not apparent in adjacent healthy trees. The fruits from the affected trees were small. The trees appeared to die back uniformly throughout the crowns, but showed no tendency to fill up with water sprouts. As a rule, there was an abrupt transition from affected to unaffected trees. The same type of decline was also noted in another fine grove a considerable distance away. Here, too, perfectly healthy trees immediately adjoined the marginal declining trees of the affected areas.

Tree decline was also observed near Lake Alfred in a grove that suffered from drought, the trees having shown partial defoliation and dying-back for several years. The root systems were in good condition, but few of the trees had made good tap-roots. The trouble is attributed to planting the trees on grapefruit rootstock, which was not adapted to the droughty character of the land.

HARVEY (J. V.). **Fungi associated with decline of Citrus and Avocado in California.**—*Plant Dis. Reptr*, xxviii, 17, pp. 565–568, 1944. [Mimeographed.]

In attempts to determine the extent to which fungi are responsible for decline or collapse of avocado and citrus trees in California, examinations were made of roots and soils from diseased and healthy avocado, lemon, and Valencia orange trees and soils in many localities over a period of 3½ months, ending on 31st May, 1944. The tabulated results show that of 167 samples of diseased avocado, *Phytophthora cinnamomi* occurred on 54·5 per cent., *Pythium vexans* on 45·5, *P. ultimum*

on 35·1, *Trichoderma lignorum* [*T. viride*] on 22·7, and *Fusarium* spp. 1 and 2 on 90·4 and 10·9 per cent., respectively, while in a second lot of 120 healthy samples the corresponding percentages were 14·1, 31·7, 29·1, 25·0, 97·5 and 16·6, respectively. It is concluded that *P. cinnamomi* may be assumed to be of primary importance with respect to pathogenicity on avocado. No conclusions are drawn from the limited data on diseased citrus isolations.

Boom sprayers in Citrus orchards.—*Calif. Citrogr.*, xxix, 10, p. 276, 2 figs. (1 on p. 277), 1944.

In 1940, the use of mechanically oscillating spray booms [*R.A.M.*, xxii, p. 476] to conserve labour in citrus spraying began to receive attention in California. While this form of spraying does not secure the depth of penetration of the foliage that is given by careful hand-spraying, there are many diseases which do not require thorough inside coverage, and, further, there is a large acreage of thinly foliated trees.

Great improvements in boom equipment have been effected. The volume of liquid obtainable under high-capacity pumps, e.g., 60 gals. per minute, appears to be fundamental to inside coverage. Much has yet to be learned about the most effective placement and angle of the nozzles. The speed of the rig and the speed and type of movement of the guns or nozzles all affect the results. The ultimate place of boom-sprayers will not be established until more experience has been gained. At present, their most important feature is that they cover a greater acreage at lower cost than other types; they also make it possible to spray by night. Details are given of two boom-sprayers now in use.

Klotz (L. J.) & Fawcett (H. S.). **Progress report on 'decline' of Citrus.**—*Calif. Citrogr.*, xxix, 10, pp. 294–295, 1944.

Describing the lines along which research on citrus decline in California is being conducted [*R.A.M.*, xxiii, p. 106], the authors state that in the lathhouse in small tanks in the presence of known rot fungi (*Phytophthora* spp.) waterlogging without drainage, using a solution of nitrates and organic matter, was rapidly fatal to 18-months-old seedlings of lemon, Tresca shaddock, rough lemon and sour orange, Valencia orange, Windsor grapefruit, Sampson tangelo [tangerine × pomelo], and a seedling grapefruit, this being the order in which they succumbed. All were dead in four weeks. Where the same materials and organisms were used, and the roots were kept wet, but the soil had better drainage, the seedlings were still surviving after nine months. Seedlings with severely infected roots rapidly recovered when placed in soil in porous pots and given ordinary greenhouse care, the growth of new roots exceeding their destruction by fungi. This suggests that a similar sequence occurs in good groves where desirable orchard practices are maintained. In order of resistance to *P.* spp. of the fibrous roots, Sampson tangelo was first, sour orange a poor second, and lemon, grapefruit, rough lemon, and Valencia orange third. The order of resistance of the trunk bark of standard stocks to gummosis by the same fungi was sour orange and tangelo first, sweet orange, rough lemon, and grapefruit next, and lemon and citrange [*Poncirus trifoliata* × common orange] last. Tests on the tendency to nitrite injury [loc. cit.] of seedlings of rough lemon, Valencia orange, Homosassa sweet [? orange], Royal grapefruit, Alonzo grapefruit, pink shaddock, bitter-sweet orange, sour orange, and Sampson tangelo showed virtually no differences. Small concentrations of nitrous nitrogen or nitrites cause no visible injury to citrus roots, but reduce their water-absorbing ability as indicated by the rate of wilting when the plants are placed under drying conditions. The apparent order of resistance to decline of Eureka lemons on various stocks were reported as (1) Sampson tangelo,

(2) mandarin orange, (3) sweet orange, (4) grapefruit, (5) rough lemon, (6) sour orange.

BITANCOURT (A. A.). **Um teste para a identificação precoce da tristeza dos Citrus.**—[A test for the early identification of Citrus 'tristeza'.]—*Biológico*, x, 6, pp. 169–175, 1944. [English summary.]

A test has been devised for the early identification of the 'tristeza' root rot of grafted oranges [*R.A.M.*, xxiii, p. 223], consisting in the application to the superficially scraped bark at the bud union of a 3 per cent. alcoholic solution of iodine. On diseased trees at the Biological Institute, Campinas, S. Paulo, Brazil, the starchy, dark-coloured parenchyma of the affected sweet orange scion contrasted sharply with the colourless tissues of the corresponding region in the immune sour orange stock, these reactions being reversed on the inner surface or phloem of the cortex. A faint response to the test may also be shown by externally healthy trees in an orchard containing diseased individuals, indicating the latent presence of the virus. Similar experiments at Riverside, California, where this form of root rot does not occur, were invariably negative.

The apparent failure in the translocation of carbohydrates through the phloem from the sweet orange tops to the sour orange roots is considered to explain the death of the rootlets and ultimately of the trees. It further lends weight to the author's theory that the disease is induced by a virus latent in the sweet orange from which the sour one is immune. The symptoms of 'tristeza', including the starch accumulation in the cortex and the death of the starved rootlets are comparable to those described by W. P. Raleigh, from the United States, as developing in Green Mountain potato scions infected by latent mosaic [potato virus X] grafted on resistant stocks of U.S.D.A. 41596 [ibid., xvi, p. 53].

VASUDEVA (R. S.). **Studies on the root-rot disease of Cotton in the Punjab. XII. Control by varying sowing date.**—*Indian J. agric. Sci.*, xiii, 5, pp. 515–519, 3 graphs, 1943.

The results of five years' experiments, mostly conducted at Lyallpur and Khanewal, Punjab, on the relation between the date of sowing of cotton and the incidence of root rot (*Rhizoctonia* [*Corticium*] *solani*) and *Macrophomina phaseoli* indicated that early (first week in April) and late (near end of June) stands suffer less severely than those of May [*R.A.M.*, xxii, p. 204]. In one test in 1938, for instance, the average mortality for 83 A.F. (*Gossypium hirsutum*) sown on 5th April, 7th and 23rd May, and 2nd and 20th June was 4, 8·9, 18·9, 13, and 1·2 per cent., respectively, the corresponding figures for Mollisoni 39 (*G. arboreum* var. *neglectum* f. *bengalensis*) being 8·4, 43, 29·1, 23·6, and 0, respectively. Both native and American varieties sown late and planted closely gave satisfactory yields, but the output of American cottons from the early sowings was low.

DASTUR (R. H.) & TASHNA (U. C.). **Studies in the periodic partial failures of the Punjab American Cottons in the Punjab. VIII. The relation of weather factors with the spread of tirak in American Cottons.**—*Indian J. agric. Sci.*, xiii, 5, pp. 449–467, 10 graphs, 1943.

The fully tabulated results of the authors' comprehensive studies on the correlation between meteorological factors and the incidence of 'tirak' in American cottons in the Punjab [*R.A.M.*, xxiii, p. 225] indicate that the years of exceptional prevalence of the disease tend to be marked by spells of abnormally warm weather, persisting for ten days and upwards and sometimes accompanied by total absence of rain, in September and October. Such conditions obtained in the years 1921, 1926, 1927, 1928, and 1932, when losses of 20 to 45 per cent. of the crops were sustained. When the correlation coefficients between yields and the degrees

(2° to 5° F.) above the normal maximum temperature were determined, negative correlations were established between temperature and yields which were significant, or on the verge of significance, in the Multan and Montgomery districts.

Ahmad (N.) & Gulati (A. N.). **The effect of storage under certain specified conditions on the quality of Indian Cottons.**—*Indian J. agric. Sci.*, xiii, 5, pp. 494–514, 1 diag., 2 graphs, 1943.

Broach Desi 8 cotton, stored in bales in Bombay for 2½ years, showed distinct signs of deterioration, including fungal damage to the fibres by *Aspergillus* sp., *A. niger*, *Phycomyces* sp., *Penicillium* sp., *Cladosporium* sp., *Mucor* (?) *hygrophilus*, and (?) *Basidiobolus* sp., of which the two last-named are new records for India. Storage in desiccators at controlled humidities below 90 per cent. relative humidity did not lead to any deterioration in bundle strength in two years, but at saturated humidity both Broach Palej and Broach Desi 8 decayed completely in four to five months. The critical limit lay between 90 and 92 per cent. relative humidity, even a slight increase above the former involving an acceleration in the rate of decay. The incidence of infection was significantly lower for Broach Desi 8 than for Broach Palej. At a constant temperature of 92° F. and varying humidities there was no decrease in strength or increase in the incidence of infection over a period of 1½ years. Sprinkling stored cotton with water invariably results in loss of strength and deterioration in colour, usually accompanied by an increase of fungal infection, which may be minimized by the addition to the water of 0·5 to 1 per cent. formalin.

Neal (D. C.). **Rhizoctonia leaf spot of Cotton.**—*Phytopathology*, xxxiv, 6, pp. 599–602, 2 figs., 1944.

A hitherto unreported leaf spot of cotton caused by *Corticium solani* was observed in mid-July, 1943, on Deltapine plants at Baton Rouge, Louisiana, and subsequently in adjacent fields on Coker, Delfos, and other varieties. The symptoms are distinctive, consisting of light brown, dark purple-bordered, interveinal spots of irregular shape and variable size, which later become necrotic, the diseased tissues cracking or falling out and presenting a ragged, shot-hole aspect. At the same time the surrounding tissues assume a chlorotic discoloration. The light to yellowish-brown mycelium of the fungus was present in abundance on and near the lesions on the lower leaf surfaces. The fungus was readily isolated on potato dextrose agar and inoculated with positive results on the Coker, Deltapine, and Delfos varieties, the incidence of infection on which amounted to 80, 60, and 83·3 per cent., respectively. Under the conditions of cloudy skies and moderate temperatures favouring infection by *C. solani*, the incubation period was about six or seven days. Although the leaf spot causes a certain amount of shedding, the reduction of yield from this source has not so far been substantial.

Drechsler (C.). **A species of Arthrobotrys that captures Springtails.**—*Mycologia*, xxxvi, 4, pp. 383–399, 6 figs., 1944.

After stating that of the predacious fungi, 3 prey mainly on rotifers, 5 habitually on testaceous rhizopods, 24 habitually on amoebae, and 29 habitually on nematodes, the author describes his study of a Hyphomycete which, though not more robust than the related nematode-capturing forms [*R.A.M.*, xxiii, p. 299], is yet adapted to prey primarily on insects; under natural conditions it is probably wholly given to a predacious mode of life. The fungus, *Arthrobotrys entomopaga* n.sp., appeared in 14 Petri plate cultures planted on 18th September, 1943, with discoloured rootlets of *Polygonum pennsylvanicum* freshly collected from moist ground near a brook in Arlington, Virginia. Bacterial development allowed

gradual multiplication of rhizopods and eelworms, which led to the development of fungi subsisting on them. On 1st November, many dead springtails of the genus *Sminthurides* were found in small areas near the decaying rootlets. The clustered arrangement of the dead insects and the constant proximity of many erect columnar processes indicated that a predacious fungus was the agent of destruction.

During the next ten days numerous additional groups of columnar processes developed, mostly at increasingly greater distances, from the root material where the first groups originated. This was accomplished by radial extension of narrow, straight, hyaline, septate, prostrate hyphae which for relatively long distances showed meagre branching. At intervals, however, these hyphae widened and gave off several branches close together and almost at right angles. Near their points of origin, the branches anastomosed or gave off secondary branches which anastomosed, so forming a hyphal net prostrate on the surface of the substratum. Many segments then sent up individually an erect process consisting of a stout, stalk-like basal cell with a wider, ovoid or prolate-ellipsoidal, distal cell. This secreted a colourless adhesive liquid. In cultures protected against evaporation the adhesive liquid often appeared as a droplet 15 to 20 μ in diameter, but more frequently it appeared as a strongly collapsed, irregularly lobate envelope surrounding the distal cell. Through secondary development a new erect process was often sent up from the base of a procumbent stalk or a prostrate distal cell; or a new adhesive process arose from an older prostrate stalk and the glandular cell originally surmounting it; or two new adhesive processes arose from a prostrate glandular cell, one or the other sometimes giving rise to an adhesive process of tertiary origin.

Borne at a height of 10 to 15 μ, the distal glandular cell was well placed for adhering to the ventral side or legs of the low-bodied prey. The abundant elaboration of sticky exudate beforehand rendered escape of the insect impossible. Owing to the close arrangement of the erect processes in groups, several of them probably often adhered to the insect at the same time.

The captured springtails were invariably permeated with mycelium, penetration being accomplished, apparently, by the glandular cells most directly operative in the capture.

Shanor (L.) & Saslow (H. B.). **Aphanomyces as a Fish parasite.**—*Mycologia*, xxxvi, 4, pp. 413–415, 1 fig., 1944.

During November, 1942, *Lebistes reticulatus*, *Anoptichythys jordani*, and a hybrid of *Platypoecilus maculatus* × *Xiphophorus helleri* in aquaria at the University of Illinois became attacked by a sterile species of *Aphanomyces* which caused the death of the fish (both adult and young) in a week after the development of the lesions. No infected fish recovered and all the species infected showed equal susceptibility. The source of the inoculum was probably food grown in containers of fresh water.

The first sign of infection was a peculiar dorsal hump, the parasite generally developing most extensively in the dorsal region. A few days later, the mycelium became evident as whitish lumps in the distended musculature. Hyphae then began to protrude from the lumps in tufts extending from the skin for a length of 2 mm. The *Aphanomyces*, which has not been identified, appeared to be solely responsible for the disease. It is evidently a facultative parasite which may become destructive under suitable conditions.

Barnett (H. L.) & Houston (B. R.). **Curly top on Flax and other Flax diseases in central California in 1944.**—*Plant Dis. Reptr*, xxviii, 15, pp. 507–508, 1944. [Mimeographed.]

During 1944, the three flax diseases present in western Tesno County, California,

in 1942–3, viz., pasmo (*Septoria linicola*) [*Sphaerella linorum*: *R.A.M.*, xxi, pp. 5, 418], browning (*Polyspora lini*) [ibid., xxiii, pp. 17, 90], and anthracnose (*Colletotrichum linicola*) [ibid., xxiii, p. 17], were relatively scarce. Curly-top disease [beet curly-top virus], on the other hand, was general throughout the area. Affected plants were first found early in March, the diagnosis being confirmed by Dr. H. H. P. Severin. Infection was highest at the margins of the fields (between 1 and 5 per cent.) in places where the stand was sparse, and in fields planted between October and the end of December. Fields planted after December showed only a few affected plants.

LACHANCE (R. O.) & PAYETTE (A.). **Quelques observations sur l'anthracnose du Lin.** [Some observations on Flax anthracnose.]—*Rep. Quebec Soc. Prot. Pl., 1936–1943*, pp. 53–55, [1944].

In October, 1942, the authors found *Colletotrichum lini* [*C. linicola*] on flax seed from crops grown in nearly every parish of the counties of Islet and Kamouraska, Quebec. Infection, however, appeared to be generalized and considerable only in the county of Islet, where the Gossamer variety is grown. Only a very small percentage of infection was found on seed of the Cirrus variety, the cultivation of which is confined to the neighbourhood of Sainte-Anne-de-la-Pocatière.

The fungus reduced germination, and in some cases destroyed the seedlings at or before emergence. Most of the plants, however, reached a height of 3 or 4 in. before anthracnose symptoms appeared. Occasionally, the fungus was isolated from apparently healthy stems and seed.

Loss of virulence did not follow prolonged exposure (in the markets) to temperatures of 30° F. below zero. The fungus was also able to withstand a temperature of 65° C. for three hours. In damp heat, on the other hand, the fungus was rapidly destroyed at temperatures over 35° C.

Seed treatment for 10 minutes in water at 126° F. destroyed almost all species of *Alternaria* without affecting germination; treatment at 136° for 10 minutes destroyed *C. lini*, but reduced germination by about 30 per cent. In trials with a number of fungicides used as seed treatments, arasan, semesan, and ceresan gave the most promising results.

MEDINA (J. C.). **'Leaf basal necrosis' of Sisal (English 81).**—*Bragantia, S. Paulo*, iii, pp. 73–84, 1943. [Abs. in *Chem. Abstr.*, xxxviii, 15, p. 4011, 1944.]

Necrosis of sisal leaf bases was effectively combated in São Paulo, Brazil, by the application of a potassium sulphate fertilizer in the first year of cultivation (two years after planting in the nursery). The affected and unaffected parts of the foliage in diseased plants, the apparently healthy parts of the same, and the foliage of normal plants contained, respectively, ash 5·334, 8·921, and 9·082; potash 0·463, 0·736, and 0·992; calcium oxide 3·726, 5·842, and 5·689; phosphorus 0·163, 0·260, 0·393; total nitrogen 1·117, 1·501, and 1·807; and magnesium oxide 0·795, 1·680, and 1·485 per cent. of material dried at 100 to 110° C.

PLAKIDAS (A. G.). **Black scale: a disease of Easter Lily bulbs.**—*Phytopathology*, xxxiv, 6, pp. 556–571, 4 figs., 1944.

Colletotrichum lilii n.sp. is the name applied to the agent of a serious disease of Easter Lily (*Lilium longiflorum*) known as black scale in Louisiana, where investigations on its etiology were carried out from 1937 to 1939. The colour of the scales of affected bulbs ranged from brown to nearly black in place of the normal white to lemon-yellow, the injury involving the epidermis and two to four layers of the subepidermal cells. The lesions predominate on the apical half and outer surface of the scales, and impart such an unsightly appearance to the bulbs as to

render them unsaleable, though the plates, roots, and core appear to remain normal.

Besides *C. lilii*, which was isolated from 178 tissue plantings from six lots of black-scale lesions, species of *Fusarium* and *Penicillium* developed in 149 and 92 cultures, respectively. In preliminary inoculation tests in the laboratory on healthy scales and bulblets, all three fungi caused rotting, the *F.* isolates being the most aggressive and those of *P.* sp. the least so. The soft type of decay resulting in each case was ordinarily very similar, but in two instances *C. lilii* induced a rather shallow, sunken, dry rot comparable to that observed in nature. In soil infestation trials, however, there was no difficulty in recognizing *C. lilii* as the agent of the typical black-scale symptoms, 91·1 per cent. infection occurring in one series and 87·5 in another. Negative results were obtained in a limited number of experiments in the control of the disease by chemical treatment of the bulbs or soil.

C. lilii is described [in English only] as having small, mostly gregarious acervuli, arising subcuticularly on a small, dark brown stroma, 43 to 122 (average 67·2) μ in diameter, and furnished with an abundance of dark brown, rigid, straight, continuous or septate setae, 29·7 to 72·6 by 4 to 5·3 (45·7 by 4·9) μ; hyaline, subconical conidiophores, 10 by 4·5 μ; and hyaline, falcate, continuous, subacute, usually vacuolate conidia, 13·2 to 23 by 3·6 to 4·9 (18 by 3·7) μ.

Smith (F. F.) & Brierley (P.). **Preliminary report on some mosaic diseases of Iridaceous plants.**—*Phytopathology*, xxxiv, 6, pp. 593–598, 1 fig., 1944.

In 1939 corms of *Tigridia pavonia* were received from a western Washington grower with the statement that a mosaic-like disease had spread rapidly through a previously normal planting. Similar mottling symptoms have been observed in *Gladiolus* in various localities, including the Plant Industry Station, Beltsville, Maryland, and in plants of *Babiana, Ixia, Sparaxis, Streptanthera cuprea, Tritonia lineata* and *T.* hybrids (*Montbretia* among them), and *Watsonia marginata*, from commercial sources in New Jersey, Ohio, and California, indicating a wide distribution in the United States of the virus or viruses concerned.

The foliage and flower bracts of plants raised from the above-mentioned *T. pavonia* corms bore pale- to yellowish-green, irregular streaks and blotches, sometimes accompanied by an inconspicuous, pale or more rarely dark, streaky 'breaking' of the flower colour. Picardy *Gladiolus* plants with 'broken' flowers were selected in the field in 1941 and grown under glass in 1942. The young leaves formed in April and May developed a fine-grained, angular, green mottling, and the flowers, pink in bud, showed a distinct pale-streaked or spotted 'breaking' when full-blown or fading. Naturally infected *Ixia* hybrids displayed either a bright yellow, angular or alternate pale and dark green mottling of the leaves and streaky, pink 'breaks' in the white flowers. Darker, 'tear-drop' flower 'breaks' were detected in *Babiana* hybrids, while those of *Sparaxis* exhibited a strong, green foliar mottling, with a frequent crinkling and pinching not hitherto observed among the Iridaceae.

The *Tigridia* mosaic virus was experimentally shown to be transmissible by means of *Aphis gossypii, Macrosiphum lilii*, and *Myzus circumflexus*, and that of *Gladiolus* by the last-named and *M. persicae*, neither being communicable through the sap. *M. persicae* further conveyed infection from mottled *Babiana, Ixia, Sparaxis, Streptanthera, T. pavonia*, and *W. marginata* to *Tritonia crocata*.

Cucumber mosaic virus was found occurring spontaneously on *Sparaxis* hybrids, whence it was transferred by *M. persicae* to Clara Butt tulips and by mechanical methods to Turkish tobacco, White Spine cucumber, *Zinnia elegans*, and *Mesembryanthemum crystallinum*.

Bergström-Kiellander (Ingrid). **Undersökningar över vissnesjuka hos Sommaraster Callistephus chinensis (L.) Nees.** [Investigations on wilt disease of the China Aster, *Callistephus chinensis* (L.) Nees.]—*Medd. Växtskyddsanst., Stockh.*, 42, 78 pp., 10 figs., 4 graphs, 1944. [English summary.]

Aster (*Callistephus chinensis*) wilt disease (*Fusarium conglutinans* var. *callistephi*) was first observed in Sweden by T. Lindfors in 1917 (unpublished information), since when it has been reported from various parts of the country. From 1939 to 1942 it was included in the investigation programme of the State Plant Protection Station. In general, the field experiments in five localities with different varieties permitted of a uniform rating in respect of reaction to wilt, but marked and so far inexplicable departures from the normal behaviour of the various aster types were observed at one place in 1941. According to Jones and Riker [*R.A.M.*, xi, p. 302], 50 per cent. resistance constitutes a reasonable line of demarcation between desirable and undesirable varieties for breeding purposes, but the writer regards this standard as unduly low and hardly likely to satisfy the majority of growers. Absolute immunity was not claimed by the American workers for any of their resistant varieties, but here again Swedish experience differs. Both in trials at the Plant Protection Institute and in several years' commercial cultivation, a number of varieties proved 100 per cent. resistant, while conversely, 100 per cent. infection was contracted by susceptible varieties in heavily infested soils: similar results were obtained by Storck in Germany [ibid., xiv, p. 447].

The author describes the symptoms of the disease, her inoculation experiments, the successful experimental control of the disease in 1939 and again in 1942 by treating aster-sick soils with formaldehyde, and cultural studies on the various fungi isolated from asters.

The *Fusarium* strains isolated from diseased plants were examined by H. W. Wollenweber and identified as *F. conglutinans* var. *callistephi*, the nomenclature of which is discussed in the light of Padwick's and Snyder and Hansen's views [ibid., xix, p. 495; xx, p. 82].

Dodge (B. O.). **Canker-blight of Pachysandra.**—*J. N.Y. bot. Gdn*, xlv, 535, pp. 159–163, 2 figs., 1944.

A planting of *Pachysandra* (closely related to *Buxus*) growing at Bronxville, New York, was observed to show a canker blight characterized by the presence of numerous dead or dying stems which either bore cankers several inches long or were dead at the tip ends for several inches down. Cuttings from healthy plants were sprayed with a spore suspension of a fungus obtained from affected material, in some cases the leaves being wounded, and it was found that brown discoloured areas developed at first only on the wounded parts, and then spread along the stems and into the leaves. When spores were placed on unwounded leaves and stems, no infection occurred, except when a leaf was kept for a long time in contact with the moist filter paper bearing the spores. The disease is considered to be due to an undescribed species of *Volutella* that is primarily a wound parasite.

The fungus appears to be widely distributed in the area. Cuttings should not be taken from plants where the disease is evident. Clipping the leaves should be avoided. The cutting knife should be dipped in alcohol after it has been used to trim off dead stems or leaves. The host should not be grown in places where it is possible for the public to walk through the plantations. If the plants develop the condition they should be treated with Bordeaux mixture or some other fungicide.

Affected material also showed the presence of bright orange-red to dark red ascocarps of a fungus belonging to the Nectriaceae. These represent the perfect stage.

Black (L. M.). **Some viruses transmitted by Agallian leaf-hoppers.**—*Proc. Amer. phil. Soc.*, lxxxviii, 2, pp. 132–144, 7 figs., 1944.

In addition to the New York and New Jersey potato yellow dwarf viruses [*R.A.M.*, xxi, p. 36], two hitherto unknown viruses were found affecting crimson clover (*Trifolium incarnatum*) colonized by the leafhopper *Agalliopsis novella*. One of these new entities causes enlargement of the veins while the other delays the opening of the leaves and imparts to the young foliage the aspect of small clubs: on the basis of these outstanding symptoms they are allotted, respectively, the common names of 'big vein' and 'clover club-leaf'. A new genus is further proposed to accommodate all four viruses under discussion, namely, *Aureogenus*, the New York, New Jersey, big vein, and clover club-leaf forms to be known, respectively, as *A. vastans* var. *vulgare* n.comb., *A. vastans* var. *agalliae* n.comb., *A. magnivena* n.sp., and *A. clavifolium* n.sp.

A. vastans var. *vulgare* was transmitted by *Aceratagallia sanguinolenta*, *A. lyrata*, *A. obscura*, and *A. curvata*; only two out of 465 tests with *Agallia quadripunctata* and possibly one out of 220 with *Agalliopsis novella* were successful. *Aureogenus vastans* var. *agalliae* was transmitted by *Agallia constricta*, *A. quadripunctata*, and possibly by *Agalliopsis novella* in one out of 241 tests. *Aureogenus magnivena* was conveyed from diseased to healthy plants by *Agallia constricta*, *A. quadripunctata*, and *Agalliopsis novella*, while the last-named was the only vector of *Aureogenus clavifolium* in these experiments.

Evidence is presented, based on the similarity of the systemic symptoms induced by both viruses in *Nicotiana rustica*, Green Mountain potatoes, *Chrysanthemum leucanthemum* var. *pinnatifidum*, and crimson clover, as well as on protection tests on the first-named host, of the very close relationship between the New York and New Jersey agents of yellow dwarf. The affinities of the big vein and clover club-leaf viruses are less clearly defined. Like the New York and New Jersey types, they cause yellowing and not a typical mosaic, but their distinctive features and failure to infect *N. rustica* and potato may be interpreted as pointing to the absence of relationship: in any case, the two new viruses do not appear to be as closely akin to the two previously described as the latter are to each other.

Hills (K. L.). **The reaction of varieties of Trifolium subterraneum to attack by Uromyces trifolii as a heritable character.**—*J. Coun. sci. industr. Res. Aust.*, xvii, 2, pp. 74–78, 1944.

When the highly susceptible, mid-season Mt Barker variety of subterranean clover was crossed with the immune, early Mulwala variety, resistance to leaf rust (*Uromyces trifolii*) [*R.A.M.*, xv, p. 810] was ascertained to be an inherited character. Susceptibility was apparently dominant, though the data were inadequate for a definite conclusion. The F_2 had 96 plants with an infection rating of 0, and 9, 17, and 205 with ratings of 1, 2, and 3 (the highest); the progeny of uninfected F_2 plants remained free from rust. There was some evidence of linkage between time of flowering and resistance, early maturity tending to be associated with resistance; however, combinations of earliness and susceptibility and of lateness and resistance were frequent. Both early and late segregates were obtained in the third generation which were immune from attack and largely possessed of the agronomic characters of the parents. It seems probable that a variety could be developed from the cross which should combine the desirable agronomic characters of Mt Barker with the rust resistance of Mulwala.

Preston (D. A.). **Diseases of grasses in Oklahoma.**—*Plant Dis. Reptr*, xxviii, 17, p. 562, 1944. [Mimeographed.]

This list of fungal diseases found on grasses growing in the Federal grass Nursery, Stillwater, Oklahoma, and the vicinity, on 3rd to 4th May, 1944, includes

the following new host records: *Colletotrichum graminicola* on *Agropyron elongatum*, *A. intermedium*, and *A. smithii*, *Ellisiella caudata* on *A. trachycaulum*, and *Scolecotrichum graminis* on *Alopecurus carolinianus*.

NOER (O. J.). **Fungicides for snow mold control.**—*Greenk. Reptr*, xii, 3, pp. 13–14, 24–25, 4 figs., 1944.

Of the various fungicides applied to park and club greens at Milwaukee, Wisconsin, for snow mould [*Typhula*: *R.A.M.*, xxiii, p. 111] control in November, 1943, calo-clor, thiosan, and Du Bay 1205 gave the most promising results, but in the absence of severe infection during the abnormally mild winter, the conclusions to be drawn from the tests are purely tentative. For the time being, northern greenkeepers should rely on a mixture of 2 parts calomel [mercurous chloride] and 1 of mercuric chloride or thiosan, the former to be applied at a dosage of 3 to 4 and the latter at 6 to 8 oz. per 1,000 sq. ft. just before the first snowfall is expected.

KEMP (H. K.) & BEARE (J. A.). **Little leaf in deciduous fruit trees and Vines.**—*J. Dep. Agric. S. Aust.*, xlvii, 11, pp. 470–479, 12 figs., 1944.

During the past few years, 'little leaf' of deciduous fruit trees caused by zinc deficiency [*R.A.M.*, xxii, p. 252] has been found in South Australia in the Murray Valley irrigation area, the Lower South-East, the eastern slopes of the Mount Lofty Ranges, at McLaren Vale in the south, and in the northern districts at Barossa Valley, Clare, Bundaleer Springs, and Wirrabara. The disease, first described from the Middle North about 1920, has been a main factor in the abandonment of orchard cultivation in some parts of that area.

In 1939–40, the condition was found to be causing great damage to stone and pome fruits on the deep sands along the Murray River. Very few apple trees are grown locally, but almost every tree examined was severely affected. Pears were affected in the older blocks, even on the heavier soil types, and peach and apricot plantings were in many cases being replanted to citrus. Such cases were very common in Mypolonga, Waikerie, Kingston, Moorook, and Buri. At Renmark, the disease appeared to have been present over a longer period, and on the soils most subject to it deciduous fruit trees had been replaced by citrus and sultana vines some years before.

The first type of tree fruit to become affected appears to be apple, followed by peach and nectarine, and then by apricot. Pears appear to be much less susceptible than apples, and citrus than stone and pome fruits. Progressive replanting to citrus of stone-fruit areas dying out as a result of little leaf is common, and in many cases the citrus trees have grown for many years without signs of damage. Replanting with stone fruits is, however, unsuccessful as a rule, the trees succumbing in a few years after a very stunted existence. Not uncommonly, when most of the trees in an affected block have been replanted to citrus, the remaining stone fruit trees have recovered.

The most susceptible vine varieties commonly grown in the Murray Valley are Muscat Gordo Blanco, Pedro Ximines, and the Zante currant. Where stone fruits in the vicinity showed marked symptoms of little leaf, these vine varieties commonly show chlorosis, particularly Gordo Muscat. Sultanas appear to be the least susceptible of the vine varieties grown on the Murray. In the most severe cases, the canes are weak and slender and have very short internodes, while the leaves are chlorotic and about one-third of normal size. The buds in the leaf axils often burst, giving rise to very short growths with leaves under 1 in. across. Vines breaking normally may become intensely chlorotic at 6 to 10 in. of cane growth, and later recover, apparently as a result of irrigation. Vines less severely affected may show no obvious symptoms, but their yield is low and their growth lacks vigour; such vines gave marked response in point of yield to zinc applications.

The treatments recommended in the light of experimental results are: for peaches, spray with zinc sulphate 30 to 50 lb. per 100 gals. for the first two years, and afterwards omit the treatment in some years or reduce the strength; for apricots, (1) spray annually with zinc sulphate, 30 lb. per 100 gals. annually, (2) apply zinc 'tingles' to the butt or main limbs, six per in. of circumference in six rows, the 'tingles' being 1 in. apart in each row; for pears, spray with zinc sulphate, 50 lb. per 100 gals.; for apples, spray with zinc oxide, 3 lb. per 100 gals. in summer, or with zinc sulphate 50 lb. per 100 gals. in winter; for vines, swab immediately after pruning with zinc sulphate, 2 lb. per gal.

Barnett (H. L.). **Stone fruit diseases in central California.**—*Plant Dis. Reptr*, xxviii, 12, pp. 424–425, 1944. [Mimeographed.]

Almonds and apricots were the only fruits generally attacked by the blossom-blight phase of brown rot in central California during the spring of 1944, *Sclerotinia laxa* being responsible for all the infection on almond (153 cultures from ten counties) and most of that on apricot (75 cultures from five counties); *S. fructicola* was isolated from only three flowers of the latter host in Santa Clara County. The cultural criteria used for the differentiation of the two species were those laid down by Leach and Hewitt [*R.A.M.*, xviii, p. 533]. *S. laxa* was further isolated from four prune flowers and *S. fructicola* from two in Sonoma County; 15 collections from the same host in Alomeda County gave rise to the former species. Cherry blossoms in Santa Clara County yielded 26 cultures of *S. laxa* and none of *S. fructicola*, whereas 29 collections from the same host in Sonoma County were identified as the latter species and only one as the former.

Evidence was obtained that the spring infection of almond rust (*Tranzschelia* [*Puccinia*] *pruni-spinosa*) in Monterey County, California, is initiated by the uredospores overwintering on old green leaves on sucker shoots.

Hildebrand (E. M.). **Prune dwarf and the Cherry virus complex.**—*Science*, N.S., c, 2590, pp. 147–148, 1944.

The results of cross-inoculation tests repeated in three successive years at the New York State College of Agriculture have shown that strain 1 of the sour cherry yellows virus [*R.A.M.*, xxiii, p. 234] and one strain of the sweet cherry chlorotic spot or mottle virus are actually strains of the prune dwarf virus [ibid., xxii, p. 487]. Comparative experiments with prune dwarf virus, ten different cultures of the sour cherry yellows and ring spot viruses, alone or combined, and two of sweet cherry chlorotic spot virus on 12 distinct varieties or species of stone fruits yielded clear evidence that strain 1 of the cherry yellows virus, inducing rosette and stunting of peach seedlings [ibid., xxii, p. 70], is likewise responsible for symptoms simulating prune dwarf on Italian prune and Lombard plum [ibid., xxii, p. 31]. Moreover, one strain of sweet cherry chlorotic spot virus invariably induces typical prune-dwarf symptoms on the two last-named hosts. Damson plums contract chlorosis and stunting when infected by the cherry yellows strain, but not as a result of exposure to the typical prune dwarf or sweet cherry strains.

Based on severity of symptoms on Italian prune, the damson, sweet cherry, and sour cherry strains fall in descending order, the same applying to the virulence of rosette, stunting, and necrosis on Rochester peach.

Rhoads (A. S.). **Target leaf spot of Papaya in Florida.**—*Plant Dis. Reptr*, xxviii, 17, p. 575, 1944. [Mimeographed.]

Papaws in Dade County and Palm Beach County, Florida, are widely affected by a target leaf spot (more serious than that due to *Mycosphaerella caricae*) which is considered by Ruehle to be the same as the disease described by Acuno and Zayas from Cuba as due to *Phyllosticta caricae-papayae*. The small, necrotic spots

are most numerous near the leaf margins but enlarge rapidly in a symmetrical fashion, becoming circular in outline. A target-like effect soon results from concentric rings of black perithecia of a species of *Mycosphaerella*. The centres of the spots eventually disintegrate, producing a ragged effect. The pathogenicity of the fungus has not yet been established.

GOODWIN (M. W.), HOPPERSTEAD (S. L.), & KADOW (K. J.). **Insecticide diluents. Solubility of arsenicals and copper fungicides as affected by diluents in agricultural dusts.**—*Soap, N.Y.*, xx, 8, pp. 103–107, 2 graphs, 1944.

At the Delaware Agricultural Experiment Station, dust mixtures were prepared, with and without calcium arsenate, using 48 different diluents, each with red cuprous oxide, tribasic copper sulphate, and copper oxychloride. In general, the lower the P_H, the higher was the water-soluble arsenic, very little of which was liberated above P_H 11. Copper oxychloride exerted the strongest buffering action of the three copper compounds, and therefore may be the safest in use in dust mixtures containing no calcium arsenate, whereas the other two, with their high P_H, are likely to give better results where the latter compound is present. It is concluded that a dust mixture containing copper fungicides without calcium arsenate should have a reaction about P_H 5, while one of P_H 11 is indicated for calcium arsenate-containing preparations.

MEYER (J. R.). **Ação bacteriostatica da 'orelha de pau' vermelha (Polyporus cinnabarinus).** [Bacteriostatic action of the red 'ear of corn' (*Polyporus cinnabarinus*).]—*Biológico*, x, 6, pp. 165–168, 3 figs., 1944. [English summary.]

Extracts from the fruit bodies of *Polyporus* [*Polystictus*] *cinnabarinus*, a common wood-rotting fungus of southern Brazil, were experimentally shown actively to inhibit the growth of the Gram-positive bacteria, *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Pasteurella avicida*. The bacteriostatic substance, which is readily soluble in water and practically innocuous to laboratory animals, retains its properties during several weeks' storage at room temperature and withstands five hours' boiling.

RAMSBOTTOM (J.). **Edible fungi.**—35 pp., 16 col. pl., 4 figs., Penguin Books Ltd., West Drayton, Middlesex, 1944. 2s.

Following an interesting account of the history, geographical distribution, past and present uses, real and legendary origins, and methods of cooking of edible fungi, the author describes, in sufficient detail for easy recognition, the outstanding characteristics of 20 British species, with other essential information relative to their preparation. The attractive coloured plates are by Rose Ellenby.

REYNIERS (J. A.). [Ed.] **Micrurgical and germ-free methods. Their application to experimental biology and medicine.**—xiv+274 pp., 3 pl., 38 figs., 40 diags., 2 graphs, Springfield, Illinois, U.S.A., C. C. Thomas; London, Baillière, Tindall & Cox, 1943. $5.00.

Included in this symposium by various authors on the applications of micrurgical and germ-free procedures to experimental biology are a chapter (III) by E. M. HILDEBRAND on micrurgy and botany with special reference to phytopathology, and one by P. R. WHITE (VIII) on germ-free plants and plant parts as material for physiological and pathological studies. The former deals, *inter alia*, with the cytopathology of virus, bacterial, and fungal diseases of plants, and the latter with the procurement and maintenance of aseptic plant material for the study of mycorrhiza, viruses, and crown gall [*Bacterium tumefaciens*]. Each of the eleven chapters comprised in the manual is supplemented by a bibliography of the pertinent literature.

MUJICA (F.). **Immunización mediante la formación genetica de variedades resistentes a las enfermedades de las plantas.** [Immunization by means of the genetic production of varieties resistant to plant diseases.]—*Bol. Sanid. veg. Chile*, iii, 1, pp. 15–30, 1943.

This is a survey of some notable recent advances in the development of immunity in plants by genetic methods.

ROSENQUIST (O.). **How Sweden produces yeast for nutritional purposes.**—*Food Industr.*, xvi, 6, pp. 74–75, 118, 1 diag., 1944.

Full details are given of the process used in Sweden for making yeast from sulphite waste liquor as a by-product in sulphite alcohol manufacture and *Torula* yeast [cf. *R.A.M.*, xxiii, p. 399] from the distillery wash. The former type, which is relatively inexpensive and of inferior quality, is used as fodder, while the latter is fit for human consumption. An outline of the necessary installations, power, material, and labour requirements, and data on costs and nutritional values are given.

POPE (S.). **A new species of Metarrhizium active in decomposing cellulose.**—*Mycologia*, xxxvi, 4, pp. 343–350, 2 figs., 1944.

An account is given of the author's study of a fungus isolated from deteriorated baled cotton stored in Washington, D.C., and found to have extraordinary activity in decomposing cotton fabric. It has been used in the evaluation of mildew-proofing agents and the resistance of fabrics to rotting. It is easily handled in culture, sporulates freely, and has remained stable in its cultural characteristics and cellulose-decomposing activity for three years.

The fungus, which is named *Metarrhizium glutinosum* n.sp. [cf. *R.A.M.*, xxiii, p. 309], when grown on filter paper produces a sparse, white mycelium in which arise small tufts of compact conidiophores that form a palisade layer in each tuft. The moist conidial masses produced on these tufts often coalesce, forming masses 0·5 to 2 mm. in diameter. The dusky olive-green to olivaceous-black, cylindrical conidia have rounded ends, measure 6 to 9·6 by 1·5 to 3·9 μ, are formed on sterigmata in basipetal succession and united by disjunctors, but break away in the conidial mass soon after formation. The penicillately branched, erect, septate conidiophores measure 50 to 85 μ in length; the ultimate branches are verticillate, composed of 1 to 3 sterigmata, and measure 10 to 22 μ in length. The chlamydospores are produced in bulbous terminal portions of the hyphae found near the substratum and embedded in the mycelium. The mature chlamydospores are almost round, smooth, buckthorn-brown, measure 7·4 to 9 μ in diameter, and have a small, tapered papilla at one side.

NORRIS (D.). **Preservation of tube cultures of fungi and bacteria with liquid paraffin.**—*J. Aust. Inst. agric. Sci.*, x, 2, p. 77, 1944.

On 24th August, 1943, week-old cultures of nine fungi were covered with commercial paraffin sterilized in an autoclave. On 10th March, 1944, subcultures of all of them were made, and grew vigorously, though the controls without paraffin were useless. The cheapness and simplicity of this technique and its remarkable effectiveness warrant its trial by plant pathologists.

BAKER (GLADYS E.). **Heterokaryosis in Penicillium notatum.**—*Bull. Torrey bot. Cl.*, lxxi, 4, pp. 367–373, 1 pl., 1944.

A preliminary account of this cytological study of *Penicillium notatum* has already been abstracted [*R.A.M.*, xxiii, p. 398]. Assimilative hyphae are plurinucleate or binucleate, and this condition is maintained in the phialides.

Bibliography of references to the literature on the minor elements and their relations to plant and animal nutrition. Fourth supplement to the third edition.—92 pp., Chilean Nitrate Educational Bureau, Inc., 120, Broadway, New York, 1943.

The present supplement to the third edition of this valuable compilation originated by L. G. Willis [cf. *R.A.M.*, xvi, p. 276], contains nearly 700 references to, and abstracts of, contemporary studies on various aspects of the relation between the minor elements and the nutrition of plants and animals. A large number of the papers deal with matters of phytopathological interest.

Sherbakoff (C. D.) & Stanley (W. W.). **The most important diseases and insect pest crops of Tennessee.**—*Bull. Tenn. agric. Exp. Sta.* 186, 142 pp., 95 figs., 1943. [Abs. in *Exp. Sta. Rec.*, xci, 2, p. 162, 1944.]

Brief descriptions are given of the principal diseases and pests of the main Tennessee crop plants, exclusive of forest trees, together with recommendations for their control. The manual further includes sections on soil management in relation to disease control, care of plant beds, seed treatment, and spraying and dusting both with plant-protectives and hormones.

Katzman (P. A.), Hays (E. E.), Cain (C. K.), van Wyk (J. J.), Reithel (F. J.), Thayer (S. A.), & Doisy (E. A.). **Clavacin, an antibiotic substance from Aspergillus clavatus.**—*J. biol. Chem.*, cliv, 2, pp. 475–486, 2 graphs, 1944.

Methods for the production, preparation, and purification of clavacin, an antibiotic substance produced by *Aspergillus clavatus* [*R.A.M.*, xxiii, p. 183], are described, and evidence is presented confirming its identity with patulin. Clavacin is active against both Gram-negative and Gram-positive bacteria and certain fungi, viz: *Rhizopus nigricans* [*R. stolonifer*], two strains of *Monilia* [*Candida*] *albicans*, two strains of *Saccharomyces cerevisiae*, and *Sporotrichum schencki*.

Kelley (A. P.). **The process of phagocytosis in mycorrhizae: with especial reference to a phenological study of mycorrhizal phagocytosis in Fraxinus americana.**—16 pp., 3 figs., Landenberg Laboratory, Landenberg, Pa, 1943. [Mimeographed.]

The term phagocytosis is here formulated broadly as 'the digestion within a cell of some substance foreign to the cell's substance' and is more particularly applied to the digestion of fungal material by a non-fungal cell. The author gives a general description of mycorrhizal phagocytosis, followed by a review of literature on phagocytosis in liverworts, mosses, pteridophytes, gymnosperms, and angiosperms.

A study of stained root material from an American white ash (*Fraxinus americana*) collected at weekly intervals from March to June led to the conclusion that the fungal material is probably held in the mycorrhizal rootlets over winter and used in the spring by a phagocytotic process in development of new tissues for the host plant. As reported by other workers for other species of hosts, the phagocytotic activity in the ash was confined to a certain region, namely the mid-cortex. In true mycorrhiza the area of phagocytosis is always localized in the innermost region invaded by the fungus. The digestion is preceded by coiling, clotting, branching, or other changes in the hyphae. These changes are ordinarily induced by immersion of the hyphae in a solution of unfavourable ionic concentration, the degree of change being related to the degree of concentration of ions in the solution. Assuming that somewhere between epidermis and central cylinder of the host plant there is a layer of cells having an ionic concentration sufficient to cause the hyphae to curl, branch, or break down, it is suggested that phagocytosis would tend to occur in such a region.

HATCH (W. R.) & JONES (R. C.). **An experimental study of alternation of generation in Allomyces arbusculus.**—*Mycologia*, xxxvi, 4, pp. 369–381, 1944.

Studies on *Allomyces arbusculus*, North Carolina strain, showed that when resistant sporangia are air-dried for 24 days, the products are exclusively sexual, this condition remaining unchanged when the resistant sporangia are brought to dehiscence in rich nutrient. The products of resistant sporangia dried for 18 days are predominantly sexual, but not exclusively so when cultured in rich nutrient. The products of resistant sporangia dried for 12 days are predominantly asexual in rich nutrient; the products of resistant sporangia dried for six days are predominantly asexual in rich nutrient, and produce some asexual plants in weak nutrient. It is concluded that drying and nutrition affect the sexual–asexual ratio of the products of resistant sporangia.

SAKSENA (R. K.) & BHARGAVA (K. S.). **Nitrogen requirements and vitamin deficiencies of Phytophthora phaseoli Thaxter.**—*Proc. Indian Acad. Sci.*, xviii, 2, pp. 45–51, 1 fig., 1943.

In the writers' experiments at the University of Allahabad, a culture of *Phytophthora phaseoli* from the Centraalbureau voor Schimmelcultures, Baarn, Holland, made no growth on a medium consisting of mineral salts, dextrose, and inorganic nitrogen, but required a special amino acid (*d*-alanine), supplemented by thiamin. Other substances providing nitrogen in a suitable form included peptone, hydrolysed peptone, casein, buttermilk, lentil or yeast extracts, and Lima bean [*Phaseolus lunatus*] infusion, all of which, except casein, also supply the necessary growth substance.

STAPP (C.). **Über serologische Virusforschung und den diagnostischen Wert serologischer Methoden zum Nachweis der pflanzlichen, inbesondere der am Kartoffelabbau beteiligten Viren.** [On serological virus research and the diagnostic value of serological methods for the detection of plant viruses, especially those concerned in Potato degeneration.]—*J. Landw.*, lxxxix, 3, pp. 161–188, 1943. [Abs. in *Exp. Sta. Rec.*, xci, 2, p. 163, 1944.]

The aspects of serological research discussed in this comprehensive survey include antigens, animal experiments, the preliminary treatment and titre determination of antisera, differential serological methods, e.g., agglutination, complement-fixation reaction, conglutination, and various precipitin and microprecipitin techniques, the adaptability of serological procedures to virus demonstration, and their limitations in the detection of plant viruses, especially those implicated in potato degeneration.

BALD (J. G.). **Transmission of Potato virus diseases. 4. Ground work studies on the growth of normal Potato foliage.**—*J. Coun. sci. industr. Res. Aust.*, xvii, 2, pp. 94–111, 3 graphs, 1944.

To obtain ancillary information useful in the study of potato virus diseases the author made periodical measurements of leaf area on potato plants of different varieties and strains during their earlier stages of development. The data obtained showed that the main determinant of maturity was the growth rate of the axillary shoots. Independently of varietal differences in the time of inception of axillary growth, early-maturing strains and varieties had a relatively slow axillary growth rate, while late-maturing strains and varieties had a relatively fast one.

SAMUEL (G.). **Some factors affecting the yield of the Potato crop.**—*J. R. Soc. Arts*, xcii, 4675, pp. 562–573, 1 map, 1944.

This stimulating discussion of the various factors influencing potato yields in the United Kingdom, presented at a meeting of the Royal Society of Arts on

26th April, 1944, contains a number of references to phytopathological matters, including the losses incurred through viruses, potato blight [*Phytophthora infestans*], and dry rot [*Fusarium coeruleum*], the present position in regard to seed potato certification, and other points of special interest to plant-breeders. The paper was followed by a discussion.

Delaney (D.) & Keenan (P.). **The building up and maintenance of healthy stocks of seed Potatoes. A review of the work.**—*J. Dep. Agric. Éire*, xli, 1, pp. 95–105, 1944.

This is a report on the progress made to date in the development and maintenance of healthy seed potato stocks in Éire. The methods employed for the object in view include regular periodic inspection by whole-time officers; elimination of diseased plants by roguing; strict regard to varietal purity; the building-up of seed stocks in the bleak, cold, wind-swept region of Co. Donegal, where the climatic conditions are unfavourable to *Myzus persicae*, the chief aphid vector of potato viruses; and the isolation of 'nucleus stocks' on land that has been several years under grass at a minimum distance of 100 yds. from other potatoes. Very satisfactory stocks of Arran Pilot and Arran Banner, for instance, are now available for greater distribution, and a gradual improvement is being effected in the health of other varieties, e.g., Kerr's Pink and Arran Victory. Particulars are given of the conditions governing the issue of certificates in respect of approved stocks.

Ruehle (G. D.). **Outstanding Potato late blight control in Florida with a new organic fungicide combined with zinc sulfate.**—*Plant Dis. Reptr*, xxviii, 7, pp. 242–245, 1944. [Mimeographed.]

Outstanding control of potato late blight (*Phytophthora infestans*) was obtained in experimental plots in Dade County, Florida, during the 1943–4 season with disodium ethylene bisdithiocarbamate [*R.A.M.*, xxiii, p. 115] (manufactured by the Rohm and Haas Company under the code number He 175) used in combination with zinc sulphate and lime. In the first test, spraying with a knapsack sprayer at three- to eight-day intervals for a total of nine applications with He 175 alone, at the strength of 2 lb. in 100 gals.; gave 163·7 bush. per acre and 76·7 per cent. U.S. No. 1 tubers; at 4–100, 186·5 bush. and 78·9 per cent.; He 175 plus zinc sulphate and lime at 2–1–$\frac{1}{2}$–100, 325·4 bush. and 90·8 per cent.; and the same combination at 4–1–$\frac{1}{2}$–100, 381·4 bush. and 93·4 per cent., whereas the figures for the untreated control were 93·8 bush. and 54·3 per cent. The increases in yield obtained from the combination are considered highly significant, and not accounted for by zinc stimulation or reduction of run-off. Spraying with He 175 plus zinc sulphate without lime caused some foliage injury late in the season and is considered unsafe. The application of He 175 in dust form proved inferior to its use as a wet spray. In a second test, spraying with a tractor-drawn power sprayer at 400 lb. pressure at six- to seven-day intervals for a total of seven applications again gave the best results with He 175 plus zinc sulphate and lime (1$\frac{1}{2}$–2–1–100) which yielded 304 bush. per acre with 293 bush. per acre of U.S. No. 1 tubers, and 6 per cent. of foliage killed by late blight 70 days after planting. The corresponding figures for the untreated control were 48, 34, and 78, respectively, and for the other fungicides tested (copper-hydro with and without zinc sulphate and lime, cuprocide with either zinc or copper sulphate and lime) between 180 and 203, 125 and 191, and 19 and 32, respectively.

Nattrass (R. M.). **Potato blight.**—*E. Afr. agric. J.*, x, 1, pp. 18–21, 1944.

Potato blight (*Phytophthora infestans*) has been present in East Africa since 1941, and must now be regarded as an endemic disease. While all authorities are

agreed that the minimum temperature required for the rapid establishment of foliar infection is about 50° F., little information is available concerning the upper limit. In Kenya [*R.A.M.*, xxi, p. 426], with a daily variation of 20° or more, nocturnal conditions may favour the spread of the fungus and those prevailing during the day retard its development, though it is doubtful whether an upper limit of 78°, given plentiful moisture, would exert any inhibitory action. The pathogen is probably perpetuated on the diseased plants which may be observed on native holdings right up to the forest line in the Kenya Highlands, while many small infected tubers survive lengthy dry periods underground and produce blighted sprouts on the development of humid conditions. Full directions are given for the control of the disease by spraying with Bordeaux or Burgundy mixture or a reliable proprietary copper fungicide, e.g., perenox, coppesan, oxycop, and bouisol, beginning when the plants reach a height of 6 to 8 in., and continuing at 10- to 21-day intervals, a total of three applications being ordinarily adequate.

THOMAS (W. D.). **Late blight of Potatoes from 'healthy' tubers.**—*Plant Dis. Reptr*, xxviii, 11, p. 399, 1944. [Mimeographed.]

In the course of experiments at St. Paul, Minnesota, in 1943 on the epidemiology of potato late blight (*Phytophthora infestans*), 39 externally sound tubers were treated with 1 in 1,000 mercuric chloride and planted in sterile soil, the emerging sprouts being covered with Mason jars to provide a humid atmosphere for the development of the fungus, if present, as well as to exclude extraneous contamination. The disease appeared at the tips of the first leaves from 20 of the tubers, and the examination of sections of the sprouts revealed non-septate hyphae throughout the phloem.

In the field, nine out of 600 hills from apparently healthy tubers (originating, however, in a contaminated seed stock) also produced blighted shoots. During the period between emergence and the appearance of symptoms on the sprouts, no spores of *P. infestans* were trapped on the vaseline-coated slides exposed daily in the experimental plot, though many were caught after conidiophores and conidia began to form on the host. These observations denote that apparently sound tubers from an infected seed stock may harbour the pathogen in a latent form.

DILLON WESTON (W. A. R.) & TAYLOR (R. E.). **Development of mould on the cut surfaces of Potato tubers.**—*J. agric. Sci.*, xxxiv, 2, pp. 93–96, 1944.

Continuing their experiments [*R.A.M.*, xxii, p. 190], the authors found that when potato cut surfaces were treated with Bordeaux and Burgundy mixtures, only slight growth of *Penicillium* sp. developed, but when the copper sulphate constituent was used separately severe contamination resulted. No growth occurred on control setts or those treated with lime water or the sodium carbonate constituent. Zinc oxide did not appear to affect suberization, and no mould growth was associated with its use. Evidence is adduced to show that the stimulation of mould growth was associated with this metallic radical and most salts of cobalt, nickel, and iron induced similar results to the copper, whereas other salts induced no such reaction, and manganese-treated tubers remained entirely free from mould.

Other experimental data indicate that the development of *P.* on potato tubers following treatment with copper salts is greater than may be explained solely on the basis of saprophyte growth following phytocidal action and the prevention of suberization. For example, delay in treating setts until the cut surfaces had suberized did not prevent the growth of *P.*, and furthermore, much sparser fungal growth occurred on tissues killed by heat than by copper salts. Under moist conditions, treatment of non-living substrates, such as straw, leather, and skin,

with copper sulphate suppresses or inhibits moulds and bacteria, possibly owing to failure by the substratum to immobilize the toxic copper and reduce toxicity, as appears to occur when living vegetable tissues are so treated.

HARTER (L. L.). **Sweetpotato diseases.**—*Fmrs' Bull. U.S. Dep. Agric.* 1059, 26 pp., 20 figs., 1944.

This useful bulletin (originally published in 1919 and revised in 1928) summarizes the information available to date on the symptomatology, etiology, distribution, economic importance, and control of sweet potato field and storage diseases [cf. *R.A.M.*, viii, p. 665]. Black rot (*Ceratostomella fimbriata*) is probably responsible for as much loss as all the other diseases combined.

JODON (N. E.), RYKER (T. C.), & CHILTON (S. J. P.). **Inheritance of reaction to physiologic races of Cercospora oryzae in Rice.**—*J. Amer. Soc. Agron.*, xxxvi, 6, pp. 497–507, 1944.

A tabulated account is given of genetic studies on the F_2 and F_3 populations of 48 crosses between rice varieties resistant, moderately resistant, and susceptible to leaf spot (*Cercospora oryzae*) physiologic races 1, 2, 3, and 4, grown at two localities in Louisiana and one in Texas from 1940 to 1943, inclusive [*R.A.M.*, xxii, p. 224]. Thirty-five F_2 crosses gave single- and 13 duplicate-factor segregations for resistance or moderate resistance versus susceptibility, comparable results being also given in a limited number of experiments with the F_3 and backcrosses. As many as three, if not more, duplicate factors may operate for resistance to a single race. One cross (susceptible Blue Rose × resistant Rexoro) segregated for resistance, moderate resistance, and susceptibility in a 12 : 3 : 1 ratio.

LE BEAU (F. J.). **Phymatotrichum root rot on Cryptostegia grandiflora, with notes on its distribution in Mexico.**—*Plant Dis. Reptr*, xxvii, 15, pp. 278–280, 1 map, 1943. [Mimeographed.]

Surveys made from February to May, 1943, in the State of Tamaulipas, Mexico, showed that the most prevalent disease of the rubber plant *Cryptostegia grandiflora* was *Phymatotrichum* root rot [*P. omnivorum*]. The disease was present in many localities where this host was growing as an escape, and was also found on six-months-old seedlings under cultivation. Heavily infected soil should be avoided in selecting areas for extensive plantings of *C. grandiflora.*

The disease was found on various hosts in 13 separate localities between San Fernando, about 100 miles south of Brownsville, Texas, and the northern corner of the state of Vera Cruz. A very extensive and heavily infected area was encountered in the prairie region in the vicinity of Manuel and Gonzalez, Tamaulipas, where several hundred acres of castor bean [*Ricinus communis*], stated to have been planted on virgin soil, were severely affected. South-west of Manuel, an area of heavy infection was found in several thousand acres of prairie being ploughed up for the first time. The disease was also found on cotton in close proximity to *C. grandiflora* near Culiacan, Sinaloa, in western Mexico.

WAKSMAN (S. A.). **Three decades with soil fungi.**—*Soil Sci.*, lviii, 2, pp. 89–114, 1944.

This is a summary of the results of investigations carried out at the New Jersey Agricultural Experiment Station during the last thirty years on the subject of fungi (excluding Actinomycetes) in relation to soil processes. The bibliography comprises over 160 titles, the majority referring to papers by the author and his collaborators published from the Station.

Chowdhury (S.). **A sclerotial disease of Black Pepper.**—*Indian J. agric. Sci.*, xiii, 5, p. 566, 1943.

A severe basal wilt disease of black pepper (*Piper nigrum*), causing losses of up to 67 per cent. in some Assam plantations, was observed in January, 1943, and found to be due to *Sclerotium rolfsii*, not hitherto recorded on this host in India. The pathogen was isolated on oat agar slants and inoculated into pepper plants with positive results.

McMartin (A.). **Pineapple disease of Sugarcane cuttings and its control.**—*S. Afr. Sug. J.*, xxviii, 6, pp. 241, 243, 245, 1944.

Pineapple disease (*Ceratostomella paradoxa*), first recognized in Natal by the writer in 1935 [*R.A.M.*, xiv, p. 470], is thought to be the predominating single cause of germination failure among sugar-cane cuttings, especially of the susceptible Co. 331, 301, and 281 varieties. The fungus is carried on the exterior of the cane used for planting and enters the sticks when they are cut in pieces, causing decay of the latter under conditions conducive to slow germination. Satisfactory control was obtained in a field experiment in 1943 by cutting the cane (Co. 331) into lengths before planting in July, dipping the cut ends into containers in the bottom of which agrosan, ceresan, or thiosan dust was sprinkled. The cuttings were planted at the rate of 100 each in $\frac{1}{48}$ acre plots, and four replications were made of each of the treatments, arranged as a 4×4 Latin square. On 1st December, the number of buds grown in the control, agrosan, ceresan, and thiosan plots were 9, 22, 24, and 17 per cent., respectively; the number of cuttings germinated were 24, 57, 56, and 44 per cent., respectively; and the number of cuttings showing positive evidence of pineapple disease 45, 1·5, 3·5, and 9 per cent., respectively.

Forbes (I. L.), Mills (P. J.), & Dunckelman (P. H.). **Red rot in windrowed Sugar Cane.**—*Sug. Bull., N.O.*, xxii, 18, pp. 148–149, 1944. [Abs. in *Sugar*, xxxix, 8, p. 45, 1944.]

When the autumn planting season in Louisiana is abnormally wet and operations have to be deferred until the spring, use must be made of seed cane that has been overwintered in windrows. This is effected by placing the cane stalks, with adhering leaves and tops, in the middles of the cane rows and covering them with two furrows of a farming plough. The examination for red rot [*Colletotrichum falcatum*] of a number of varieties treated in this manner showed the C.P. varieties 29/120, 33/310, and 29/103 to be almost perfect windrowing canes for seed purposes; 26/116, 33/425, 29/230, and 36/105 are also satisfactory; and 33/243 and 34/20 are susceptible to the disease.

Abbott (E. V.) & Summers (E. M.). **Disease testing and initial seedling resistance at Houma in 1943.**—*Sug. Bull., N.O.*, xxii, 18, pp. 144–148, 1944. [Abs. in *Sugar*, xxxix, 8, pp. 43–44, 1944.]

Since 1935 the three outstanding problems in cane variety selection in Louisiana have been (1) to obtain a satisfactory substitute for Co. 281 for windrowing; (2) to secure earlier maturing varieties suited to heavy and mixed soils; and (3) to replace C.P. 28/19 by an equally precocious cane of a superior type and less expensive to harvest. In each of these projects the question of disease resistance was an important consideration. Progress towards the first of the three objectives has been made with the release of C.P. 34/120, which will yield a higher sugar tonnage when windrowed than Co. 281 and is less susceptible to mosaic and root rot, though far more so to chlorotic streak [*R.A.M.*, xxii, p. 39]. The former selection is also a contribution to the second project, provided particular care is taken to keep seed supplies free from chlorotic streak, which is usually more prevalent on heavy soils. C.P. 34/120 can further be used to a limited extent for

early milling. A great obstacle to the realization of the third of the above-mentioned objectives lies in the fact that a majority of seedlings with a high sucrose content are either low in vigour, of poor type, or susceptible to one or more of the major diseases. Hitherto the only new seedling that has maintained an average sucrose level equal to that of C.P. 28/19 is C.P. 36/62, which stubbles so poorly, however, as probably to be excluded from consideration as a commercial cane. The use of the other most likely selection, C.P. 32/253, appears to be restricted to muck soils where there is no fear of the spread of mosaic.

ZUNDEL (G. L.). **Notes on the Ustilaginales of the world. IV.**—*Mycologia*, xxxvi, 4, pp. 400–412, 1944.

This further instalment of the author's annotated list of smuts newly described or newly recorded from different parts of the world [*R.A.M.*, xxii, p. 454] includes *Ustilago cynodontis* on *Cynodon dactylon* from Tanganyika Territory, *Sphacelotheca cruenta* on sorghum from Chenkung, Yunnan, China, *Sorosporium reilianum* on sorghum from Kweichow, China, and *Urocystis tritici* on *Triticum* sp. cult. from Cauquenes, Chile.

MALIK (S. A.) & KHAN (M. A.). **Parasitic fungi of the North-West Frontier Province.**—*Indian J. agric. Sci.*, xiii, 5, pp. 522–527, 1943.

A list is given of 105 fungal pathogens of plants collected, mostly by the senior author, in the North-West Frontier Province during the last five years. Among the records listed may be mentioned *Fusarium orthoceras* var. *ciceris* [*R.A.M.*, xxiii, p. 325] on *Cicer arietinum*, *Piricularia oryzae* on wheat, *Cronartium ribicola* and *Puccinia ribis* on red currant, *P. coronata* on *Rhamnus dahuricus*, and *F. udum* var. *crotalariae* on *Crotalaria juncea*.

WALLACE (G. B.) & WALLACE (M[AUD] M.). **Supplement to the revised list of plant diseases in Tanganyika Territory.**—*E. Afr. agric. J.*, x, 1, pp. 47–49, 1944.

Further records are listed of plant diseases in Tanganyika Territory since the publication of the revised list in 1937 [*R.A.M.*, xvi, p. 410].

GRAHAM (V. O.). **Mushrooms of the Great Lakes region.**—*Spec. Publ. Chicago Acad. Sci.* 5, vii+390 pp., 49 pl., 1944.

The extension of the area covered by W. S. Moffatt's 'Higher Fungi of the Chicago Region' (Part 1, 1909, Part 2, 1923) to include southern Wisconsin, southern Michigan, and the entire States of Illinois, Indiana, and Ohio, has increased the number of woody, leathery, and fleshy fungi involved from 400 to 1,200 in 18 families. The present critically annotated list is supplemented by a key to the genera represented, a dictionary of descriptive terms, and an index.

GODBOUT (F.). **La rotation, condition essentielle au contrôle de la mosaïque du Tabac jaune.** [Rotation, the essential condition for controlling mosaic in yellow Tobacco.]—*Rep. Quebec Soc. Prot. Pl., 1936–1943*, pp. 64–65, [1944.]

After stating that from 1934 [when this crop was first grown locally] to 1936 only a few yellow tobacco plants were affected by mosaic in Montreal (where the growers had been instructed in the usual control methods), the author points out that in 1937 the disease was present in more than half the plantations, i.e., over an area of 363 French acres out of 460. From 1938 to 1940 the losses increased considerably. At present, moderately infected fields are quite common at the start of the season, and by autumn, plantations are commonly found to show 75 per cent. infection. One reason for this situation is that some growers do not practise rotation, and the virus can overwinter in the soil and reinfect the crop the following season. Many growers are unable to practise rotation because they do not possess

enough land, while others find clearing and ploughing up new ground too slow and expensive by routine methods. By the use of a tractor furnished with a bull-grubber new ground is being cleared and confidence is expressed that all growers will soon practise rotation with a consequent reduction in losses from the disease to a minimum.

Clarke (E. J.). **Studies on Tomato nutrition—I. The effect of varying concentrations of potassium on the growth and yields of Tomato plants.**—*J. Dep. Agric. Éire*, xli, 1, pp. 58–81, 2 pl., 4 graphs, 1944.

The writer's studies at University College, Dublin, in 1941 and 1942, on the effect of varying supplies of potassium sulphate on the growth and yields of Potentate tomatoes afforded no evidence of any consistent connexion between the amount of this element present in the plants and blotchy ripening [*R.A.M.*, xvii, p. 777]. An increase in the incidence of blossom-end rot and chlorosis, however, was apparent at the higher levels of potassium manuring, e.g., $\frac{3}{4}$ or 1 oz. per plant per application as a base, and $\frac{3}{8}$ or $\frac{1}{2}$ oz. as a top dressing, while *Botrytis* [*cinerea*] was favoured by a deficiency of the mineral, which further enhanced the susceptibility of the plants to low-temperature injury.

The symptoms of potash deficiency in these investigations differed somewhat from those described by other workers, and included a darkening of the foliage (not always a constant feature), a yellow-green pallor of the tips of the distal leaflets, gradually spreading to the entire leaf, and a brittle, papery texture and grey-brown marginal scorching of the affected upturned leaflets. These manifestations were sometimes, but not invariably, preceded by a peppering of the leaves with small, reddish-brown spots.

Leach (J. G.) & Berg (A.). **Successful control of tip blight of Tomato.**—*Plant Dis. Reptr*, xxvii, 21, p. 590, 1943. [Mimeographed.]

The virus of tip blight [a strain of spotted wilt] of tomato, which occurred in epidemic form at Morgantown, West Virginia, in 1942 [*R.A.M.*, xxii, p. 502] and had caused over 50 per cent. reduction in the crop for two successive years, was found to be transmitted by *Thrips tabaci*, an insect harboured by the weed *Galinsoga parviflora* in addition to tomato, chilli, and numerous ornamentals. Excellent control was obtained by thorough eradication of weeds in and near the greenhouse, reduction of the number of plants in late summer to the minimum required for propagation, and a spraying programme consisting of alternate applications of a proprietary contact insecticide (Loro) and the standard tartar emetic solution: during the autumn and winter the treatments were given fortnightly, but after planting out in the early spring the young tomato and chilli plants were sprayed alternately with the two preparations at intervals of one week or less.

White (N. H.). **Virus diseases of Tomatoes.**—*Tasm. J. Agric.*, xv, 2, pp. 37–44, 10 figs., 1944.

Brief, popular notes are given on the symptoms, causes, and control of the chief virus diseases of tomatoes in Tasmania. The most frequent of these, and the most damaging, is spotted wilt, though fern leaf, streak, and big bud are also present. The paper concludes with a short list of other virus diseases occurring on tomato.

Seaver (F. J.). **The horse-hair fungi.**—*Mycologia*, xxxvi, 4, pp. 340–342, 1 fig., 1944.

In December, 1943, horse-hair blight was found on scrub oak [*Quercus ilicifolia*] in Louisiana, the strands being at first mistaken for spiders' webs. As far as is known, the fungus represents the mycelial stage of a *Marasmius*, based on material

collected in Australia and described by Kalchbrenner as *M. crinis-equi* (*Grevillea*, viii, p. 153, 1879). Berkeley (*J. Linn. Soc. Lond.*, xviii, p. 383, 1883) changed the spelling to '*equicrinis*', but the author considers that the original spelling should be retained. The American material agreed closely with Petch's description of the type species (*Ann. R. bot. Gdns Peradeniya*, vi, pp. 43–44, 1915). Only one previous collection appears to have been reported from continental North America.

Ezekiel (W. N.), Nelson (C.), & Mueller (E. R.). **Sclerotium rolfsii seedling blight of Walnut, Catalpa, and Russian Olive.**—*Plant. Dis. Reptr*, xxvii, 23, pp. 636–637, 1943. [Mimeographed.]

At a nursery of the Texas Forest Service situated in a region where *Sclerotium rolfsii* is prevalent on tomatoes and other plants, the same fungus has been found killing black walnut [*R.A.M.*, xx, p. 614], *Catalpa speciosa*, and *Elaeagnus angustifolia* seedlings, from all of which it was readily isolated in pure culture. In *C. speciosa* the disease assumed the form of a typical post-emergence damping-off, the stems collapsing just above the ground and a straw-coloured to deep brown, sharply constricted lesion extending to about 2 cm. above the crown. On *E. angustifolia* the crown lesions were of a conspicuously dark reddish-brown colour and extended up the stem for a distance of up to 3 cm. Some 25 plants were killed, mostly in groups of two to four. The sclerotia produced in culture by isolates of *S. rolfsii* from *E. angustifolia* were brown, spherical to slightly elongated, averaging 1 mm. or less in diameter, with a maximum of 1·4 to 1·5 mm.

Dodge (B. O.). **Volutella buxi and Verticillium buxi.**—*Mycologia*, xxxvi, 4, pp. 416–425, 1944.

After referring to the fact that when a branch of blighted dwarf English boxwood [*Buxus sempervirens*] bearing leaves infected with *Hyponectria buxi* was placed in a damp chamber, *Verticillium buxi* and *Volutella* [*Chaetodochium*] *buxi* [*R.A.M.*, xii, p. 634; xxiii, p. 320] often developed, the author presents detailed evidence in confirmation of Juel's view (Mykol. Beitr., IX, *Ark. Bot.*, xix, pp. 1–10, 1925) that these two organisms are distinct.

In *Verticillium buxi* the sporophores are generally snow-white and evenly scattered over the under sides of the leaves. The conidia germinate slowly on potato dextrose agar, and mycelial growth is also very slow. The mycelial mat is tough. The first aerial growth consists of whitish, erect branches, while later growth is zonate, some zones being light pink to rose or peach. Old plate cultures are deep rose. The spores are broadly spindle-shaped and pointed at the ends, and are held together in long, white chains. In very moist conditions the conidia mass together and become slightly roseate. On potato dextrose agar in old cultures the conidial masses are deeply roseate. Infection experiments with living plants proved that the fungus is not a primary leaf blight, infecting living leaves under bell jars only with difficulty.

While the feature that distinguishes a *Volutella* from related genera is the presence of setae round the margin of the sporodochium, many sporodochia of *C. buxi* have none. The sporodochia may arise beneath the epidermis, emerging as whitish, later roseate or coral pads. They often develop on short stalks composed of compacted mycelial growths which have come through stomatal openings. The setae are short and coarse, and have blunt ends. They arise from the base of the fruiting structure, and grow up round the margin. A characteristic mark is the ruby-red drops of sticky substance at the tips, which harden on drying, but readily dissolve in water, so that both in nature and in herbarium specimens the hairs may not show the red heads. The conidia germinate quickly on potato dextrose agar, the mycelium growing about five times as fast as does that of *Verticillium buxi*. The hyphae are also coarser. Growth is whitish, becoming light

pink or dull peach. In plate culture it is dappled, and the mat is not leathery. The conidia resemble those of *V. buxi* in shape and size, but are more rounded or elliptical and vary greatly in size. As the conidia develop, they are held in a drop of clear, watery substance.

When living boxwood plants were sprayed with a conidial suspension of *C. buxi* and kept under bell jars, numerous leaves became infected within a week, but no sporophores of *V. buxi* developed.

In agreement with earlier authors Juel referred the perfect stage of the *Volutella* to *Nectriella rousseliana*, but believed the perfect stage of *C. buxi* to be an undescribed species of *Nectriella* which he named *N. coronata*.

Ascocarps developed on the author's material. Along with *C. buxi* and *Verticillium buxi* there appeared chlorophyll-green fruiting bodies about the size and shape of a *Nectriella*. As they enlarged, they developed stiff hairs over the surface. The perithecia resembled the one figured by Juel for *N. rousseliana*, except that in the author's specimens the hairs were always capped with bright ruby-red heads. These setae resembled those on the sporodochia of *C. buxi*, but were thicker, stiffer, and, occasionally, more numerous. As the perithecia developed, the chlorophyll-green changed to black-green and then to amber brown. Nearly all these ascocarps collapsed without showing any asci or spores which could be determined as ascospores. *N. rousseliana* var. *viridis* Berk. & Br. 1859 differed from the original species only in the green colour of the perithecia.

The real *V. buxi* looks like a white *Penicillium*. It is probably safe to conclude that when *P. roseum* has been reported on boxwood either *V. buxi* or *C. buxi* was present, or they both were.

Rhoads (A. S.). **Diseases affecting Tungoil plantations in Florida.**—*Plant Dis. Reptr*, xxvii, 19, pp. 484–486, 1943. [Mimeographed.]

Details are given of destructive outbreaks of root rot [*Clitocybe tabescens*] in tung oil (*Aleurites fordii*) plantations in various parts of Florida [*R.A.M.*, xxi, p. 497], especially on land bearing numerous oaks prior to clearing. A serious feature of the disease is its tendency to escape notice until an advanced stage of infection is reached and the trees can no longer be saved. The fungus usually invades the root system extensively before spreading far enough upwards on the root crown to kill the bark at the base of the tree. A gummy degeneration of the tissues stimulated by the advancing mycelial sheets may be expressed by the formation of short longitudinal fissures in the living cortex, through which masses of gum exude and harden on exposure to the air. The death of patches of bark at the tree base is commonly accompanied by blackening of the tissues, which emit a noxious odour. Bark beetles frequently attack trees in this declining condition, and the sifting-out of sawdust through the minute holes made by the insects may be a sign of the final phase of infection by *C. tabescens*. The wood of the larger roots and butts is deeply penetrated by the fungus, which induces a white rot of the delignifying type and causes the formation of radial cracks filled with whitish xylostroma.

Among other new hosts of *C. tabescens* may be mentioned *Tibouchina glandulosa*, *Grewia* (?) *occidentalis*, *Ficus* sp., *Casuarina lepidophloia*, sand pear (*Pyrus pirifolia*), camphor, deodar, and privet (*Ligustrum lucidum*).

A severe outbreak of thread blight, *Corticium stevensii* (= *Pellicularia* [*C.*] *koleroga*) [ibid., xxii, p. 372], accompanied the root rot over an area of 130 acres on low-lying land where the closely spaced trees were unduly crowded and shaded. The former disease spreads rapidly during the warm, humid summer weather, causing heavy defoliation and death of the leaves, twigs, and branches. Pruning appears to be ineffectual against *C. koleroga*, which may, however, be combated by spraying.

WAGENER (W. W.) & CAVE (MARION S.). **Phytophthora canker of Madrone in California.**—*Plant Dis. Reptr*, xxviii, 9, p. 328, 1944. [Mimeographed.]

Phytophthora cactorum was isolated in August, 1943, from the margins of basal cankers on Pacific madrones (*Arbutus menziesii*) [*R.A.M.*, xxii, p. 459] near the Grass Valley, California. The fungus was observed to be proceeding up the trunk in the form of bluntly wedge-shaped extensions of the dead areas. Attempts at the isolation of the pathogen in the following November gave negative results, indicating the quiescence of the disease under local conditions during the autumn.

SIGGERS (P. V.). **The brown spot needle blight of Pine seedlings.**—*Tech. Bull. U.S. Dep. Agric.* 870, 36 pp., 2 pl., 2 graphs, 1944.

Brown spot needle blight (*Scirrhia acicola*) [*R.A.M.*, xix, p. 248] constitutes one of the most serious impediments to increased production of southern longleaf pine (*Pinus palustris*), which furnishes 40 per cent. of the American supply of turpentine and rosin, makes up a large proportion of the total annual cut of southern yellow pine, and, by reason of its long fibre, is well adapted for paper pulp.

Some of the information presented in this summarized report of studies, which have been in progress since 1929, on the various aspects of the disease is already covered by previous contributions [ibid., xx, p. 186], but the following important facts may be noted. *S. acicola* has been observed in all the coastal States from North Carolina to Texas, and inland in Arkansas, Tennessee, and Ohio, while a single collection has also been made in Oregon on *P. attenuata*. Of the 24 pine species or varieties attacked, ten are native to the south-east and 14 occur as exotics in the east; the former group includes *P. caribaea*, *P. glabra*, *P. rigida*, *P. strobus*, *P. taeda*, and *P. virginiana*, and the latter *P. coultheri*, *P. halepensis*, *P. latifolia*, *P. nigra* [var.] *poiretiana*, *P. pinaster*, *P. pinea*, two varieties of *P. ponderosa*, *P. radiata*, *P. sabiniana*, and *P. thunbergii*.

Under dry conditions in the laboratory (temperature 60° to 93° F. and atmospheric humidity 25 to 90 per cent.), the conidia of *S. acicola* from fruit bodies on *P. thunbergii* needles from Florida soon began to lose their germinative capacity, and 24 days after collection the germination percentage was only 11 compared with 83 for a corresponding series kept in a refrigerator at 5° to 15° C. and 80 per cent. humidity. The upper thermal limit for germination lay at about 35° and the lower between 5° and 10°, while the minimum, optimum, and maximum growth temperatures were found to be slightly below 5°, just above 25°, and 35°, respectively. The alkaline and acid limits for germination occurred between P_H 8·3 and 8·9 and below 4·3, respectively. The average diameter of nine conidial isolates after a fortnight's growth on potato dextrose agar was 2·65 mm., or approximately the size of single macular lesions on *P. palustris* needles. A minimum period of 14 days was requisite for the development of viable conidia in monospore cultures.

Local dissemination of the conidia was experimentally shown to be effected by the splashing of rain, whereas air currents are largely responsible for the dispersal of the ascospores. These organs are only formed on *P. palustris* after the death of most of the needle, and are the origin of a general but low-degree infection commonly appearing in the spring on the foliage of seedlings shortly after a winter fire.

The dwarfing effect of brown spot on the early growth rate of seedling *P. palustris* stands was studied under natural conditions by controlling the disease with fungicides over a protracted period and comparing the subsequent development of the plants in the treated and adjacent unsprayed rows. In Washington Parish, Louisiana, the height increment of one stand has already been delayed by over ten years. In a second plantation, the average heights of the sprayed and untreated

seedlings at the end of the eighth season in the field were 11 ft. 2 in. and 1 ft. 1 in., respectively. In central Louisiana, the average height of a lot of seedlings sprayed four times in five years was more than double that of the untreated seedlings in the same four-year-old plantation. Complete defoliation as a seasonal pathological process retarded the annual height growth in the next season to one-seventh or less of that of sprayed healthy seedlings in adjoining rows. At least three successive annual defoliations were necessary to weaken the seedlings sufficiently to cause death, which assumes the form of an attrition process that may continue unnoticed for years. By retarding rapid growth in height for upwards of a decade, *S. acicola* contributes indirectly to low survival, though other factors may be the immediate cause of mortality.

The growth capacity of stunted, diseased longleaf pines can be promoted by heavy applications (of the order of 3,400 lb. per acre) of a 3–10–3 fertilizer, but neither soil amendments nor spraying, except under nursery conditions, appear to be economically feasible as control measures against brown spot. The minimum spray schedule needed to guarantee a satisfactory sapling stand—two semi-annual treatments applied during each of the first two seasons in the field—would increase the cost of a plantation by at least $4 per acre. It is concluded that the periodic use of fire is the rational procedure where the disease is serious on reproduction areas.

Erdtman (H.) & Rennerfelt (E.). **Der Gehalt des Kiefernkernholzes an Pinosylvin-Phenolen. Ihre quantitative Bestimmung und ihre hemmende Wirkung gegen Angriff verschiedener Fäulpilze.** [The pinosylvin phenol content of Pine heartwood. Its quantitative determination and its inhibitory action on infection by various rot fungi.]—*Svensk Papptidn.*, xlvii, 3, pp. 45–56, 12 figs. (9 col.), 1 diag., 1944. [Swedish and English summaries.]

A method for the quantitative determination of pinosylvin and pinosylvin monomethyl ether in pine heartwood [see above, p. 465] has been worked out. Extracts of the wood are purified until mainly phenolic constituents remain. The pinosylvin phenols, when oxidized with potassium permanganate, yield benzoic acid, which is readily estimated. The red coloration of the heartwood caused by bisdiazotized benzidin runs parallel with the pinosylvin phenol content, thus affording a basis for colorimetric procedures. The amount of pinosylvin is higher at the butt (over 1 per cent.) and in the branches (up to 3 per cent.) than in the trunk, and the periphery of the heartwood usually contains more (sometimes five or six times) than the centre, in which connexion it is of interest to note the preference of wood-destroying fungi for the latter region.

In experiments to ascertain the relative capacity of different wood-destroying fungi to attack the sap- and heartwood of 50-, 100-, and 150-year-old pine blocks, *Lentinus squamosus* was almost as destructive to the former as to the latter, causing 35·3, 29·7, and 28·6 per cent. loss of weight, respectively, in the heartwood of the three age groups compared with 34·7, 34·5, and 34·9 in the sapwood. The corresponding figures for *C. cerebella* [*C. puteana*] were 5 and 28·8, 21 and 29, and 24·4 and 31·6 in the 50-, 100-, and 150-year groups, respectively, and for *Polyporus vaporarius* [*Poria vaporaria*], 3·9 and 45·7, 21·6 and 38·6, and 15·7 and 31·7, respectively. In another test on 200-year-old blocks, *L. squamosus* again caused almost as extensive disorganization of the heartwood as of the sapwood, the loss of weight in blocks taken from the tree at a height of 1 in. above the ground being 20·2 and 25·4 per cent. in the peripheral and central heartwood, respectively, and 25·6 in the sapwood, while the corresponding figures for blocks from a height of 7 in. were 25·2, 25·2, and 28·8, respectively. In the blocks 1 in. above ground, *C. puteana* destroyed 16·7, 22·7, and 21·3 per cent. of the peripheral and central heartwood and sapwood, respectively, the corresponding figures for *P. vaporaria*

being 1·4, 37·9, and 30·4, respectively; in the 7 in. series, the losses due to *C. puteana* in the three regions of the wood were 21·2, 24·6, and 24·9 per cent., respectively, and to *P. vaporaria*, 9·8, 33·5, and 31·5, respectively.

No explanation can yet be offered of the remarkable anomalies between the aggressive behaviour of these fungi in nature and their collapse in the presence of the pinosylvin phenols in culture.

Mook (P. V.) & Verrall (A. F.). **Recent tests on sap-stain control.**—*Sth. Lumberm.*, clxix, 2118, pp. 59–61, 1944.

In further tests on sap-stain [*Ceratostomella* spp. and other fungi] and mould (*Trichoderma* and *Penicillium*) control [cf. *R.A.M.*, xx, p. 388] on southern yellow pine [*Pinus* spp.], sap gum [*Liquidambar styraciflua*], and yellow poplar [*Liriodendron tulipifera*] timber in Mississippi, Alabama, Louisiana, and North Carolina, the most encouraging results were obtained with mixtures of borax and the phenolic or mercuric compounds widely used for the purpose in view. Two such mixtures are already on the market under the names of permatox 10 S and noxtane. Other effective mixtures consisted of 1 lb. dowicide G, 1 lb. santobrite, or ¼ lb. lignasan with 10 lb. borax, and the triplex combinations of ¼ lb. lignasan, ½ lb. dowicide G, and 6 lb. borax per 50 gals. water. Similar mixtures of dowicide H or P with borax may prove useful for the treatment of hardwoods only.

Ludwigs (K.). & Schmidt (M.). **Die Krankheiten und Schädlinge der Gemüsepflanzen, der Küchenkräuter und wichtigsten Arzneipflanzen. 2 Aufl.** [The diseases and pests of vegetables, pot-herbs, and the most important drug plants. Second Edition.]—190 pp., 11 col. pl., 110 figs., Frankfurt a.d. Oder, Gartenbauverlag Trowitsch u. Sohn, 1942. RM. 6. [Abs. in *Z. PflKrankh.*, liii, 8–12, p. 291, 1943.]

The review by H. Blunck of this manual on vegetable and kitchen-garden plant diseases and pests describes it as successfully reducing, within a narrow compass, a voluminous amount of material, the scope of which fits it to serve as the basis of a text-book, while interest is provided for the expert, too, in the chapter on non-parasitic disorders.

Studies in vegetable seed treatments in 1943.—*Plant Dis. Reptr, Suppl.* 145, 97 pp., 2 graphs, 1944. [Mimeographed.]

This supplement is the 1943 report of the Vegetable Seed Treatment Subcommittee of the Seed Treatment Committee to the American Phytopathological Society. It summarizes the tests made by 60 co-operators with 13 vegetable crops in 34 States and 2 Provinces of Canada [cf. *R.A.M.*, xxiii, p. 371].

C. M. Haenseler (pp. 7–10), dealing with sweet corn [maize] seed treatments (semesan jr. at the rate of 0·1875 per cent. by weight, arasan 0·0937, 0·1875, and 0·3750 per cent., and spergon 0·937, 0·1875, and 0·375 per cent.), shows that the treated seed gave significantly higher germination rates than the untreated in all but two of 126 comparisons. Arasan and spergon significantly increased germination more often than did semesan jr. used at the same rate. At all three dosages, arasan increased germination rather more often than did spergon. Both gave progressively better protection as the dosage was increased. The greatest number of 'weak' seedlings occurred where the total germination was poorest and vice versa, indicating that greater benefits may be derived from seed treatments than are shown in the total emergence figures ordinarily employed in evaluating seed protectants. Yields were measured in only one test, in which 0·375 per cent. arasan-treated seed gave the highest germination and yield.

G. L. McNew (pp. 11–18) describes experiments in which Thos. Laxton pea seed was treated with spergon, arasan, or fermate at 0·34, 0·17, and 0·08 per cent. The

results demonstrated that all three materials can profitably be used as pea seed treatments. Significantly improved emergence resulted in 69 per cent. of the localities, and yields were increased by an average of 15 to 30 per cent. Of the three materials, spergon was the most consistently beneficial, and gave almost as good results at 0·17 per cent. as it did at double this rate. The other treatments gave the best results at 0·35 per cent.

J. C. Walker and W. W. Hare (pp. 19–21) give the results of Lima bean [*Phaseolus lunatus*] treatments with spergon and fermate at the rates of 0·2 and 0·1 per cent. For practical purposes, the results indicate the use of spergon at the lower, or fermate at the higher rate.

R. H. Porter (pp. 22–25) gives the results of tests with spergon (0·156 per cent.) and arasan, semesan jr., and fermate (0·104 per cent.) with soy-bean. Each treatment significantly increased germination as compared with the controls.

R. H. Porter (pp. 26–30) shows that in 47 tests spinach seed treatment with arasan, fermate, and zinc oxide significantly increased emergence. Data from ten tests showed that the treatments reduced post-emergence damping-off, the most effective in this respect being arasan (1 per cent.), which reduced it by 10 per cent.; the treatments recommended to control seed decay and reduce damping-off being arasan (0·5 per cent.), fermate (0·75 per cent.), or zinc oxide (2 per cent.).

L. D. Leach (pp. 31–35) gives the results of tests in which seed of Detroit Dark Red garden beet was treated with yellow cuprocide, arasan, and ceresan. All three materials appeared to improve emergence. Arasan appeared to be a favourable treatment, a dosage of about 0·5 per cent. being satisfactory.

S. P. Doolittle (pp. 36–38) deals with trials of tomato seed protectants. The treatments used were yellow cuprocide (1·5 per cent.), arasan (0·3 per cent.), spergon (0·3 per cent.), new improved ceresan (five minutes' soak in a 1 in 1,200 dip), and copper sulphate (one hour's soak in a solution of 2 oz. in 2 gals. water). Fifteen trials were made, nine in the greenhouse and six in the field; six of the greenhouse trials were made in soil known to be infected with *Pythium* spp. or artificially infected before planting. All the treatments gave significantly better stands than the controls in three of ten trials, while four of five treatments were effective in three other trials. Copper sulphate soak, yellow cuprocide, and arasan dust seemed slightly superior to the other treatments, but new improved ceresan was quite effective.

A. G. Newhall (pp. 39–45) describes trials against onion smut [*Urocystis cepulae*], in which seed dusting with arasan and fermate (both at 100 and 75 per cent.) was tested against liquid formaldehyde (1 per cent.) and liquid catex (1 and 2 per cent.), the liquids being dripped on to the seed at the rate of 15 c.c. per ft. of row. The results varied with the localities, but appeared to indicate that the best treatment under all conditions was liquid formaldehyde, though in some instances catex was almost as good, and both dusts at the heavier rate of application gave yields equal to those obtained with formaldehyde. In seed treatments against tomato damping-off [ibid., xix, p. 519] thiosan (2 per cent.) appeared to give the best results, followed by fermate (1·5 per cent.), yellow cuprocide (1 per cent.) being a close third.

C. N. Clayton (pp. 46–55) found that the disinfection of seed potatoes is frequently not profitable.

S. P. Doolittle (pp. 58–59) found that the most effective cucumber seed treatment of those tested for improving emergence was arasan (0·3 per cent.).

Two experiments by C. J. Nusbaum (pp. 60–62) indicated that, as regards effect on sprout production, sweet potato seed treatment with fermate 1 lb. plus hydrated lime 1 lb. to 12½ gals. water (instantaneous dip) or borax (1 lb. to 6 gals. water, 10-minute soak) offers a promising substitute for mercurial treatment.

G. Semeniuk (pp. 63–75) describes maize seed treatments against soil-borne

organisms, using semesan jr., barbak D (6 per cent. mercuric phenyl cyanamide), and spergon at the rate of 1½ oz. per bush., and arasan (Du Bay 1205-AL) at the rate of 1 oz. per bush. The experiments were made in eight States on Illinois hybrid 960 and a compounded mixture of seeds of ten commercially grown hybrids. Plantings on different dates were carried out in adjacent areas, and maximum soil temperatures of about 55° F. during spring with accompanying wet conditions appeared to coincide with significant benefits in emergence from seed treatment. Barbak D was generally inferior to the other fungicides. In Minnesota, arasan gave significantly better results than any other treatment. In Missouri, spergon was significantly superior to the other treatments. In Iowa, arasan, spergon, and semesan jr. benefited emergence to about the same degree. In Wisconsin, semesan jr. and arasan were somewhat more effective than spergon. In Illinois, Indiana, and Ohio (26th April planting), spergon and arasan gave the greatest benefit.

Benefits from seed treatment in reducing mesocotyl necrosis were noted for all planting dates in Iowa, where semesan jr. gave the best reduction and barbak D was generally the least effective. Reductions in primary root necrosis appeared significant with semesan jr. in several instances. Similar data on root necrosis in Ohio showed no consistent advantage for any one treatment. No differences in mesocotyl necrosis between semesan jr.-treated and untreated seed were noted in South Dakota.

Isolations from necrotic primary roots in Ohio revealed a species of *Gibberella* affecting many of the roots. In South Dakota, isolations from eight infected mesocotyls yielded *Fusarium* from five, and *Pythium* sp., *P. debaryanum*, and no organism from the remaining three. The Iowa isolations yielded chiefly *F. moniliforme* [*G. fujikuroi*] alone or with *Trichoderma*, and an unidentified chlamydospore-producing organism abundantly present on the roots. A few mesocotyl tissues yielded only *T.* or *Mucor* sp., while one mesocotyl gave *G.* sp. Necrotic primary roots from the first and last dates of planting yielded chiefly *Helminthosporium* sp. and *G. fujikuroi*, while those from the third–fourth dates of planting chiefly gave an unidentified chlamydospore-producing organism followed by *H.* sp. and *G. fujikuroi*. All three fungi were generally associated, with *H.* sp. dominating the association. The chlamydospore-producing organism was much more abundant on plantings of the third–fourth dates than on those of either the first or last dates. *Pythium* and *Rhizoctonia* [*Corticium*] were found mainly on the earlier-planted maize. *Diplodia zeae* was isolated from the primary root of one plant in the early-planted maize.

B. Koehler (pp. 76–79) reports the results of seed treatment tests on oil-type soy-beans with semesan, fermate, new improved ceresan, and spergon. In each plot of two rows, one was inoculated with nodule bacteria before planting and one left uninoculated. In every area except Urbana, Illinois, inoculation was associated with decreased yields, both in the treated and control rows. For all the stations together, every treatment was better than the control, but seed treatment for soy-beans is not at present recommended.

G. L. McNew (pp. 80–91) and W. Crosier and R. H. Porter (pp. 92–97) discuss the treating of seed before distribution.

Gould (C. J.). **Vegetable seed-treatment tests in western Washington, 1943.**—*Plant Dis. Reptr*, xxvii, 22, pp. 594–601, 1943. [Mimeographed.]

A tabulated account is given of a series of 30 vegetable seed-treatment tests conducted at the Western Washington Experiment Station in 1943 with a number of up-to-date fungicides intended to serve as substitutes for the standard copper and mercury compounds in an eventual war emergency. The most consistently effective preparations were arasan, spergon, 2 per cent. ceresan, and semesan.

Spergon (1·5 per cent.), for instance, increased the average lettuce stand from 20 to 78 per cent., while ceresan at 1 per cent. raised that of spinach from 17·8 to 78·4. Fermate gave promising results in several trials, but its range is more limited than that of the chemically nearly related arasan. The latter and ceresan were uniformly beneficial to beet, spinach, and Swiss chard [*Beta vulgaris* var. *cicla*], while the use of spergon and ceresan insured satisfactory stands of legumes (peas, beans, and Lima beans [*Phaseolus lunatus*]). In general, small seeds responded most favourably to high (1·5 or 2 per cent.) or medium (0·75 or 1) concentrations, while larger ones were not materially affected by this factor, except in the case of ceresan, which was toxic to maize, peas, and beans, especially the last-named, at 2 per cent. but not at lower dosages.

Afanasiev (M. M.), & Morris (H. E.). **Diseases of Sugar Beets in crop rotations at the Huntley Branch Station, Huntley, Montana, from 1936 to 1941.**—*Bull. Mont. agric. Exp. Sta.* 419, 23 pp., 3 figs., 1943. [Abs. in *Exp. Sta. Rec.*, xci, 2, pp. 166–167, 1944.]

Seedling sugar beet diseases were rife from 1936 to 1941 in 18 out of 20 unmanured rotations under observation since 1912 or 1916, whereas manured successional crops were relatively healthy. Beets in those plots of the unmanured series in which lucerne figured for several years suffered considerable damage from phosphorus deficiency, which was virtually absent in the manured crops. Yellows occurred in the one-, two-, and three-year rotations but was barely noticeable in those of four or six years. Nitrogen deficiency was invariably present at midsummer in the unmanured annual to triennial rotations. The prevalence of seedling diseases and phosphorus deficiency in the unmanured rotations points to soil depletion as the predominating factor in the pathological developments investigated.

Hutton (E. M.). **The field emergence and yield of garden Peas as affected by treatment of the seed with fungicidal dusts.**—*J. Coun. sci. industr. Res. Aust.*, xvii, 2, pp. 71–74, 1944.

Owing to the prevalence of pre-emergence damping-off of peas in Australia, seeding rates of 3 to 4 bush. per acre are often necessary to obtain a satisfactory stand. In an experiment conducted in two localities, with poor and good soil, respectively, on the former, the field emergence of William Massey seed treated with spergon, ceresan, and cuprox (2 oz. per bush.) was, respectively, 65·04, 49·06, and 52·01 per cent., as compared with 44·87 for the untreated control, whereas on the latter the corresponding figures were 76·37, 66·88, 62·59, and 64·19 per cent., respectively; with Greenfeast seed the figures on the poor soil were 78·75, 66·96, 76·83, and 64·73, and on the good soil, 87·19, 83·16, 83·53, and 83·09 per cent., respectively.

In a second experiment, 50 samples of seed from different parts of Australia and New Zealand were treated with spergon only, and three sowings made at monthly intervals beginning towards the end of October. The data obtained showed that the mean percentage field emergence varied from one planting to the next, the tendency being towards a poorer emergence as the season advanced from cool spring to hot summer. The difference between the dusted and undusted seed did not vary significantly from one sowing to the next, and ranged from 8·55 to 13·42 per cent.

The results showed that the field emergence of the poorer seed was improved by spergon to a point where it approached that of good seed, but the best seed was not benefited by spergon dusting to any marked degree. On the average, the William Massey samples were much poorer than the Greenfeast; with the former, the dusted and undusted samples gave, respectively, 69·32 and 53·1 mean per-

centage field emergence, as against 88·04 and 83·29 per cent., respectively, for Greenfeast.

None of the dust treatments significantly increased yields.

McNew (G. L.). **Which varieties of Peas need treatment? Pea seed treatments as crop insurance.**—*Canner*, xcviii, 19, pp. 14, 16, 26, 28, 30; 20, pp. 20–22, 46, 48, 50, 5 figs., 1944.

The conclusions reached in the 1940 field trials of pea seed treatments in respect of spergon, semesan, red cuprocide, 2 per cent. ceresan, and new improved ceresan have been substantiated by further tests during the past two seasons and therefore still stand. They showed that spergon [*R.A.M.*, xxii, p. 338 *et passim*] consistently produced the heaviest yield increases in the Surprise, Green Admiral, and Pride varieties. Red cuprocide and ceresan were also generally effective as seed protectants, semesan gave excellent results but proved somewhat costly, while new improved ceresan had to be excluded from further consideration on account of its adverse influence on growth and yield in some fields. Very promising results have also been obtained with two new preparations, arasan and fermate, used at dosages of 1 and 2½ oz. per bush., respectively. In one test at Geneva, New York, spergon (1½ and ¾ oz. per bush.) and fermate raised the percentage of emergence from 66 for the untreated rows to 82, 81, and 81, respectively, the average yield increases for the lower dosage of spergon and for fermate being 832 and 703 lb. per acre, respectively. In 1941 and 1942, yellow cuprocide (1 oz. per bush.), spergon (2 oz.), 2 per cent. ceresan (2½ oz.), and red cuprocide (2½ oz.) were tested on a number of commercial varieties, the emergence of which (average of all) was raised in the former year from 61 to 72, 79, 73, and 74 per cent., respectively, and in the latter from 77 to 78, 85, and 81 for yellow cuprocide, spergon, and red cuprocide, the figure for ceresan being the same as the control.

In 1942, the emergence of untreated strains 243 and 256 of Surprise and 209, 242, and 255 of Perfection in steamed soil ranged from 95 to 99 per cent., compared with 1 (Perfection 255) to 67 per cent. (Perfection 242) in soil inoculated with *Pythium ultimum*; for seed treated with spergon (2 oz.) the corresponding range was from 49 (Perfection 255) to 93 per cent. (Surprise 256). In a series of tests in chambers at different soil temperatures, seed decay was more severe on both varieties at the lower range (58° to 67° F.) than at the higher (84° to 90°), while the reduction in yield at the former amounted to 57 and at 90° to 12·17 per cent.; up to 84° the disease was quite prevalent, so it may be assumed that field temperatures will seldom be sufficiently high to promote escape from infection. Seed treatment reduced the 57 per cent. loss in the low temperature series to 14 per cent. and eliminated that incurred at the higher range. A temperature of 76° may be regarded as the optimum for seed germination and plant growth. In two tests to determine the effect of soil moisture on the virulence of seed decay by *P. ultimum*, the percentage of emergence of Superlaska ranged from 6 to 11 in very wet to 91 and 92 in slightly dry soil, the corresponding figures for Laxton, Surprise, Perfection, and Pride being 0 under the former and 77 and 83, 82 and 88, 76 and 85, and 68 and 73, respectively, under the latter conditions. About 3 per cent. more soil moisture was required to produce a given amount of decay in Superlaska than in the other varieties, representing two or three extra disease-free days for germination while the hyphae of the fungus, which grow at the rate of 1½ to 2 in. a day, penetrate and destroy the seeds of the sweet varieties.

Pea seed treatment pays for itself if it fulfils any one of the three following requirements: (1) saves over 3½ per cent. of the seed from decay, (2) increases the yield by 20 lb. per acre, or (3) prevents complete failure of the stand in one field out of fifty.

BURKHOLDER (W. H.). **Xanthomonas phaseoli var. fuscans on Beans in New York State.**—*Plant Dis. Reptr*, xxviii, 15, pp. 496–497, 1944. [Mimeographed.]

Examination of diseased Michelite bean seeds from six different fields in New York showed the presence of smooth, glassy, yellow spots, often covering the entire surface. Dilution plates were made with nine seeds, and in eight the only organism found was *Xanthomonas phaseoli* var. *fuscans*. This organism, hitherto considered to be comparatively rare, was reported by the author in 1930 as having been found in Switzerland in 1924 and 1927 [*R.A.M.*, ix, p. 695]; it was later isolated by Miss F. Hedges from bean seed from South America, and in 1937 it was found by R. D. Wilson in Wisconsin; it has also been reported from Russia [ibid., xix, p. 383].

RAPHAEL (T. D.) & WHITE (N. H.). **Varietal resistance to halo blight in Beans.**—*J. Aust. Inst. agric. Sci.*, x, 2, pp. 76–77, 1944.

In a small-scale bean variety trial in Tasmania, it was noted, following a natural infection by *Pseudomonas medicaginis* var. *phaseolicola*, that Little Mary Bean, Hawkesbury Wonder, Clarendon Wonder, and Light Blue Lake showed no infection, Staley's Surprise, New Discovery, Granada, and Black Wonder showed mild to moderate infection, and Burpee's Stringless, Tweed Wonder, Wellington Wonder, Canadian Wonder, Brown Beauty, and Refugee severe infection. There appeared to be a fairly even distribution of inoculum, so that the reactions of the varieties can be taken as a good indication of their resistance to this disease under Tasmanian conditions.

TIMS (E. C.). **Further observations on white rot of Allium in Louisiana.**—*Plant Dis. Reptr*, xxvii, 15, pp. 280–281, 1943. [Mimeographed.]

Sclerotium cepivorum, first reported on garlic, shallot, and onion in Louisiana in 1942, has now spread into adjacent localities. Most of the infected areas, however, are scattered and the heavily diseased portions of the fields are comparatively small, ranging from two to three acres in extent. Preliminary tests showed that the fungus grows very poorly on certain liquid culture media at P_H over 7. The P_H value of several soil samples from affected fields ranged from 5·5 to 6·6. The reaction of the surrounding healthy areas was not appreciably different. No infection was found in fields with P_H not below 7.

Observations showed that under favourable conditions shallot plants in the field can be killed by the disease in 22 days. Wild onion (*Allium canadensis*) was found affected for the first time, the symptoms being similar to those on shallot or garlic except that in most cases the plants were not completely killed. Wild onion plants placed in pots and inoculated with macerated, severely affected shallot plants developed typical symptoms and died in a few weeks. The presence of the disease on wild onion suggests how difficult it may be to eradicate it, even though susceptible hosts are not cultivated for many years.

Modifications of regulations governing the importation of Potatoes into the United States. Amendment No. 6 to the regulations governing the importation of Potatoes into the United States.—U.S.D.A., B.E.P.Q., 1 p., 1944.

The purpose of the present amendment, effective as from 15th April, 1944, to the regulations governing the importation of potatoes into the United States [cf. *R.A.M.*, xvi, p. 352], is to add the State of Tamaulipas to the list of Mexican States enumerated in Amendment No. 5 (comprising Chiapas, Guanajuato, Jalisco, Queretaro, San Luis Potosi, and Sonora) whence entry is permitted through certain designated ports.

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